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W. J. JOHNSTON, Editor and Publisher.

T. COMMERFORD MARTIN, JOSEPH WETZLER, } Associate Editors.

E. P. THOMPSON, Associate Editor Patent Department.

CLARENCE E. STUMP, Business Manager.

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THE indicator for secondary batteries described in another column is a simple adaptation of a well-known phenomenon observed in the storage battery. As the charging of the battery proceeds, the decomposition of the lead oxide causes an increase in the density of the electrolyte. The reverse action takes place upon the discharge of the cell, and thus a ready means is afforded of determining its condition. While this phenomenon is one very convenient of practical application, there are others which are observed and might equally as well be made the basis of apparatus designed for a similar purpose. We leave it to our inventive geniuses to single out the suitable actions and to model apparatus for practical utilization as indicators.

OUR esteemed London contemporary, the *Electrical Review*, makes a warm and eloquent defense of English originality and inventiveness in the electrical field, the occasion of its remarks being a recent little note of ours on the remarkable growth of telegraphy and telephony during the last sixteen years in this country, where electrical applications are unchecked by governmental interference or monopoly. The fact is, as we readily and gladly admit, that England is well to the front in all electrical invention and enterprise, and has a most honorable and enviable record. But we think that she has nevertheless suffered greatly from having her telegraph and telephone service in governmental hands. This opinion, too, is not held solely in America, neither is it in any way disparaging to the many able officials who are to be found carrying out efficiently and with intelligence the heavy work of their respective departments.

THAT the primary battery will continue to occupy a prominent position notwithstanding the existence and development of the dynamo, there can be no doubt. While the latter has an enormous field of operation, it nevertheless leaves considerable room for its precursor, and the improvements which are now being rapidly introduced looking to a more efficient and lasting solution will go far toward counteracting the prejudice which exists against the use of the voltaic battery for domestic purposes. Until the distribution of electricity from central stations becomes an established fact in all our large cities, the battery, whether primary or secondary, will be an important factor in the supply of electrical current, and all the work bestowed upon it will be found remunerative. Even after that time there will be as much demand for a battery as there now is for candles and kerosene, in the presence of the gas works, so that no fear need exist of a general cessation of its use.

WE remarked the other day that the men who have brains and money in happy combination are paying very close attention to electric lighting, and are investing in it throughout the country. On the other hand, there are some men who have money without brains or education, and who still keep up their stupid fight against electricity. An instance of the kind has recently been brought to our notice. A week or two ago, in a city that has lately bought a plant from one of the leading Western companies, the richest man, with a "derangement of epitaphs" that would have done credit to Mrs. Malaprop, said angrily: "Our council has gone into the descendency and over our objurgations seems bound to put in the celestial light." This reminds us of the man in a town in this State who, when it was proposed to light the place by electricity, said that the light would be no good unless they could sell it in cans as cheaply as oil. Such looseness of idea and expression in regard to the subject tries the patience of some people in electric lighting, and, after all, it may well be that the general want of familiarity with electrical matters has been one obstacle to the advance of the light. Still, that obstacle becomes daily less formidable.

OUR article in another column describing some improvements in telemetry, suggests the idea that meteorological research might be greatly extended by the means which are placed at general disposal by such a system. Such an automatic and continuous register for temperature, barometric pressure, the direction and velocity of the wind, etc., would allow of an increase in the number of signal stations with very little increased expenditure. The transmitter itself evidently requires no special care whatever, an occasional examination only as to its condition being necessary. Any number of such transmitting instruments might be placed a hundred miles apart and the wires led to a single receiving station with the corresponding receiving instruments. A single attendant would thus be practically placed in charge of a large number of stations, and his weather forecasts would be made far more comprehensive than those which could be deduced from the same number of stations as now equipped, in which the observations of each have to be communicated to a single headquarters. Indeed, with an extended application of this system, the whole country might be divided into a few districts, with a single headquarters for each, and these alone would have communication with the central office of the signal service at Washington. This would also obviate the necessity of keeping observers in dangerous and isolated positions for several months in the year. The top of Mount Washington, for instance, equipped with these instruments, might probably remain deserted during the severe winter months without causing an interruption of the service, and other stations might be mentioned to which the same reasoning could be applied. Such a system might not necessarily cause a reduction in the number of observers in the Signal Service, for each man could then be placed in charge of a district comprising several stations, whereas at present he is limited to a single station. This system, or any such, is well worthy the attention of our Signal Service authorities.

THE promoters of electric lighting in England breathe more freely now they see before them the prospect of a removal of the onerous legislation imposed by the Electric Lighting Act of 1882. That act put a dead stop to all lighting from central stations, and only isolated plants, we believe, have thus far been undertaken. Recently, however, Lord Rayleigh has introduced a bill into the House of Lords, the object of which is to place electric lighting upon the same basis as gas, and it seems likely that the long and loud complaints against the present law will, now that they are taken up and re-echoed by Lord Rayleigh and other men of like influence, be attended to. Yet while England is thus trying to correct the evils into which she fell from a not unnatural fear of new monopolies, France takes a headlong plunge into darkness and submits to fresh official bondage. The French government demands, under its latest regulations, the taking out of a license for any and every piece of wiring, and requires an inspection of all electric installations. Indeed, so comprehensive have the provisions been made that the putting up of a call-bell circuit necessitates the procurement of a license with subsequent inspection. The absurdity of this is apparent. All goes to show that inquisitorial legislation may have a most depressing effect upon growing industries. It can be relied upon, as a general thing, that the representative engineers of electrical distribution will guard against all dangers that are known, not only for the protection of the public but for their own welfare and good repute. We are not arguing against legislation, but against a superfluity of it. Reasonable regulations are always desirable, especially in countries where capital is timid and where the public feels that it must be helped to protect itself from bodily injury. In countries where no great restrictions are laid by the government upon such enterprises, the rapid growth of an industry soon leads to the establishment of rules and regulations, which become law as it were, without formal enactment. Thus among us the insurance regulations govern the essential details in electrical wire service, and for obvious reasons they are followed almost universally. The results are gratifying, and strengthen the point we seek to make, that governments should be slow to put their heavy hand on new electrical developments, of whatever nature.

WE give in full to-day the annual report of the American Bell Telephone Company, presented at the meeting held this week in Boston. It is an unusually long document, and, we think, an unusually able one, handling all the vital questions connected with telephony in a very free and vigorous manner. As might be expected, great attention is paid to the Pan-Electric scandal and the government suit to break the Bell patent. Not the least valuable part of the report, in fact, is its history of the whole affair that has so lately filled the papers, and is now undergoing Congressional investigation. The Bell Company has been accused of influencing the press to attack Mr. Garland and his associates, but now makes a positive denial of having done so "directly or indirectly." The report also states very forcibly the reasons why the government should not be allowed to bring suits of the kind now sought to be instituted, but we cannot help thinking that, as a general and necessary principle, under proper restrictions, there must always remain the power in the hands of the government to reclaim privileges it has bestowed should it appear that fraud has been used to obtain them. This right of re-entry, however, should be very rarely and carefully exercised, and certainly should not be open to such abuses as have made themselves evident in the attack on the Bell Company. Another part of the report presents clearly and plainly the constitutional points raised by the Indiana rate war and the recent decision of the Supreme Court of Indiana upholding the right of the Legislature to fix prices for telephone service. The desire of the report that the public might become better informed as to the cost of operating telephones is being realized, though the first effects are not the most cheering. As to the revenue of the company, the report remarks with great justice: "While it is true considerable returns have been received upon our property since 1883, it is equally true that for years we were without dividends or other income from our investment; our patents have but seven years more to run, and we are still working, as always before; under a heavy fire and an expenditure for defense which nothing but a prospect of liberal returns would, for a moment, justify. To undertake such a work as has just been outlined, large sums are required for construction." It is within the power of State legislatures to so alarm capital that might be attracted to such a business, that it would be wholly useless for a time to attempt any important work of the kind suggested. The attack upon rates is one of the most direct methods of removing all inducement to extend telephone facilities; but even if the right to absolutely regulate this matter were conceded, the question whether the few thousand persons who now are connected with telephone exchanges shall have telephone service a little cheaper than at present is of trifling importance to the country, compared to the completion of a telephone system adequate to the needs of the whole people." The last clause refers to the long-distance work, concerning which the company feels most hopeful, its aim being nothing less than the provision of a complete system throughout the country, giving facilities for instant conversation between all points—even those hundreds of miles apart. Touching the subject of underground wires, it will be observed that the report predicts that within a few years the open wires in all large cities will be placed in cables, over or underground, to such a degree that the overhead wire "nuisance" will no longer be serious. Altogether, the document is one far above the average of such productions, and it is one deserving of thoughtful perusal by every one interested in electrical matters.

Discussion of Prof. Hughes' Paper.

At a recent meeting of the Society of Telegraph Engineers and Electricians, the discussion took place on the admirable paper of Prof. D. E. Hughes, which has just appeared in our columns, and relating to the nature and behavior of self-induction in electric circuits.

The first speaker was Lord Rayleigh, who remarked that there appeared to be a certain ambiguity in the meaning of some of Professor Hughes' results, due to the nature of his induction bridge apparatus, which was different from that used by Clerk-Maxwell and others. This ambiguity in question consisted of a doubt as to whether the bridge of Professor Hughes distinguished between the effect of resistance and true self-induction. Lord Rayleigh explained his meaning from Clerk-Maxwell's treatise on electricity and magnetism, and showed that Maxwell's formulæ gave some of the experimental results of Professor Hughes, though not all by any means. In fact, the more the paper of Professor Hughes is considered the more it will be seen to contain new observations and discoveries. Doubtless, also, Professor Hughes will be able to explain the point raised by Lord Rayleigh to his satisfaction, when the discussion terminates.

Lord Rayleigh referred to some experiments of his own made in order to determine whether or not a definite magnetic force was necessary to magnetize iron and steel. From the action of the telephone it would seem that this was not the case, although some authorities on the subject hold that it is the case. Lord Rayleigh found that there was a magnetic response on the part of the iron to very small magnetizing forces, and proportional to these. The forces employed in his experiments ranged from the one-thousandth part to the one-fifth part of the horizontal component of the earth's magnetism. With forces greater than these the action became more complicated.

Mr. F. L. Pope, of New York, pointed out several things in his own experience as a telegraph engineer, which were explained by the paper of Professor Hughes for the first time. One was that he had found a rapid telegraph instrument, tried in America a good many years ago, worked best on stranded iron wire. Again the Bain chemical telegraph, tried a few years ago between New York and Philadelphia over a line 100 miles long, was found to give a speed of 1,000 words per minute, but only on a copper-iron line, that is to say, a line of iron wire coated with copper. Both of these results are explained by the observation of Professor Hughes that in a stranded iron or a coppered iron wire the self-induction is less than in a solid iron wire. The fact that the fine coils of telegraph instruments are often fused by lightning currents in spite of the stout wire earth connection provided for the latter, is also explained by Professor Hughes; and so also is the fact that small electromagnets "in parallel" respond better to the current than larger magnets in series.

Professor George Forbes expressed the opinion that the higher "resistance" found by Professor Hughes during what is called the "variable period" or period immediately after the current enters the wire, and while it is rising to its maximum, may be a new effect not directly attributable to real resistance, but rather to the circulation of the induced current in the wire; this circulation being due to the higher electromotive force at the centre of the wire than at its outside. Professor Forbes gave a very clear exposition of his meaning, and showed how these internal currents would act in producing Professor Hughes' result. The point is one which will no doubt receive the attention it deserves from Professor Hughes and others.

Professor Forbes also drew attention to the fact that the iron sheathing of submarine cables must increase the induction of the wire, and suggested that Professor Hughes' experiments might lead to a modification of the existing type of cable. For example, a sheathing of gunmetal instead of iron would give the strength required while reducing the induction.

Dr. John Hopkinson also offered a few remarks, in which he reminded his hearers that a current rises fastest and falls fastest on the outside of a conductor, on making and breaking. He also pointed out that the magneto-telephone is extremely sensitive because the iron has great magnetic permeability under the conditions of the instrument.

A Secondary Battery Indicator.

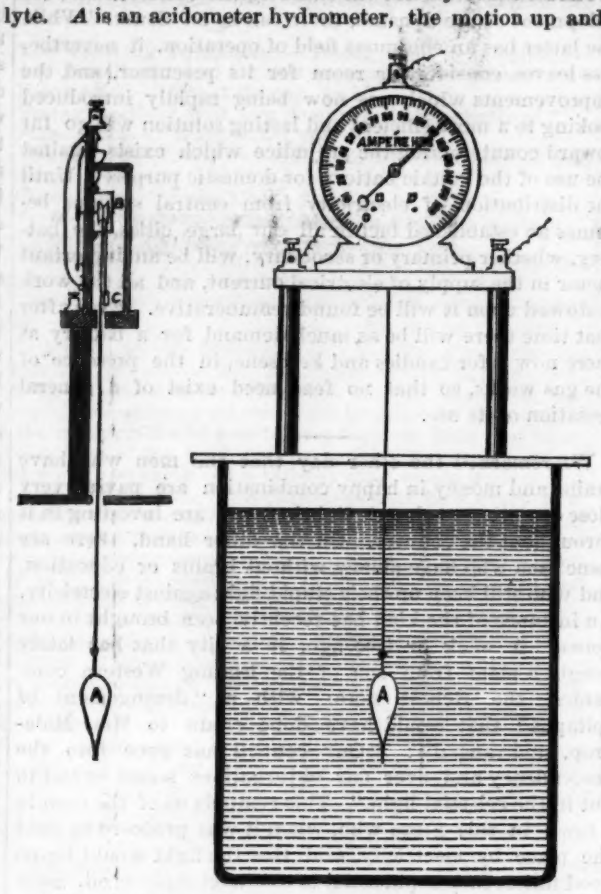
Now that the working of secondary batteries is beginning to be better understood, the necessity of a reliable indicator and current manipulator is recognized, not only for isolated installations to prolong the life of the plates, but also in distributing stored electrical energy over wide areas—a feature which will soon receive the attention it deserves.

One of the indications by which the condition of the secondary cell can be determined, is that of the density or specific gravity of the electrolyte, which varies with the charge of the cell. An ingenious apparatus, devised for this purpose by Mr. J. S. Sellon, is described by a correspondent of the London *Electrician*. By its use, the condition of the cell is shown at all times.

Our illustrations, Figs. 1 and 2, show the apparatus in section and in elevation. *A* is a platinum or glass bulb or float, which is in the cell. Attached to this is a fine wire of glass or of platinum, to which is joined a silk thread. This silk thread passes over wheel *B*, ending with a cup or weight *C*, adjusted to the desired weight. This arrangement is similar to the action of a wheel barometer.

Under ordinary conditions of working, 10 degrees of density may be taken as representing 100 ampère-hours, which gives considerable motion to the bulb or float. It is obvious that the wheel *B* can be made of such a size as to give large or small readings.

Our illustration, Fig. 3, shows an automatic current manipulator or charging switch, whereby any number of sets of cells may be brought in or cut out of the charging circuit, through the rise and fall of the density of the electrolyte. *A* is an acidometer hydrometer, the motion up and



Figs. 1 and 2.—Secondary Battery Indicator.

down of which causes wires 1 and 2 to make contact with the mercury in cups *B* and *C C*.

It will be seen by the sketch that on the fall of the acidometer through the discharge of the cell, contact is made by wire 2 2 with mercury cups *C C*; this connects up one or two cells with magnet *D*. This magnet, by attracting its keeper *E*, opens the circuit at *F F F*; this causes the charging current, if acting, to pass through the wire of solenoid *H*, which, by attracting its core *I*, switches in resistance, short-circuits the same, and finally connects up the cells with the charging main. Contact springs *J J* break the connection of magnets *D* and *M*, opening the one which has operated, closing the other ready for the next operation. This prevents waste of current which

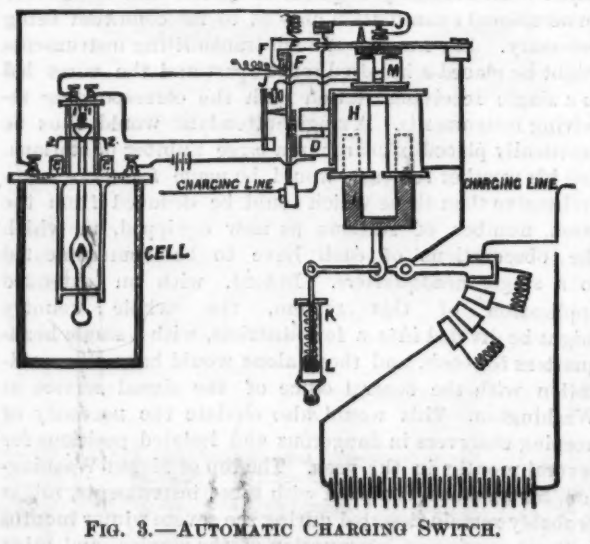


Fig. 3.—Automatic Charging Switch.

would take place, as the contacts at 1 and *B* and 2 and *C* remain closed until an alteration of the specific gravity occurs.

The opposite action takes place on completion of charging contacts being made at wires 1 1 with mercury cup *B*. This actuates magnet *M*, which, by attracting its keeper *N*, causes the end of the keeper *E* to spring in and lock at *F F F*, thereby short-circuiting solenoid *H*, which releases its core *I*, spring *K* in dash-pot *L*, switching in resistance, connecting up, and thereby disconnecting the set of cells from the charging main.

It will be seen that by such an arrangement sets of accumulators can be readily switched in and out of the charging circuit at any desired point of charge or discharge.

The Centenary of Arago.

The celebration of the centenary of Arago, which has lately taken place at Perpignan, France, under the auspices of Mons. Granet, Minister of Posts and Telegraphs, may render a short account of this celebrated scientist of some interest. Francois Arago was born at Estagel on Feb. 26, 1786, and was educated at the College of Perpignan. At 17 years of age he was admitted into the Polytechnic School after a most brilliant examination. Notwithstanding his political opposition to Napoleon, the Emperor in 1806 selected him, in conjunction with Biot, to carry out certain meridional measurements upon which the metrical system is based. During these operations Napoleon declared war against Spain, and Arago, after having been a prisoner of war, captured by a privateer, confined on a hulk, and passing through numberless adventures, managed to return to France, having saved his instruments and papers. At the age of 23 he was Member of the Academy of Sciences, Professor at the Polytechnic School, and a little later, Director of the Observatory. One of his most remarkable attributes was the wonderful simplicity of his language and the ease with which he gave popular explanations of the most difficult problems, the most abstruse theories or experiments. His lectures at the observatory were followed with the greatest interest by old and young, scientists and ladies of fashion. He took some share in politics, being elected Deputy for the Pyrenées Orientales, in 1830, but did not succeed very well, being probably too plain spoken, for his political opinions, although he belonged to the extreme left, were the real cause of the present Municipal Council of Paris refusing to participate in the celebration. When 44 years old he was elected as Life Secretary to the Academy of Sciences. Although he refused allegiance to the Second Empire, the admiration of his worth and his scientific attainments was so great, that he was allowed to enjoy his various appointments and the honors and dignities showered upon him by nearly the whole of Europe. He died in 1853, at the age of 67.

Obituary—M. Auguste Guerout.

We regret to announce the death of M. Auguste Guerout, for the past five years one of the editors of *La Lumière Electrique*. After finishing his university life in France, he studied first at Goettingen under Prof. Woehler, then at Manchester, England, in the large chemical works of Mr. Grace Calvert, where, in addition to completing his technical education, he acquired a knowledge of the English and German languages. On returning to Paris he entered the laboratory of Antoine Cæsar Becquerel, and afterward accepted an appointment in the firm of Ruhmkorff. At this time he contributed articles to *La Lumière Electrique*, the secretaryship of which was offered to him toward the close of the year 1880. He died at the village of Sainte-Croix-Montvilliers (Seine Inférieure) on the 28th day of February, after a long illness. Those who were fortunate enough to have become acquainted with M. Guerout at the Philadelphia Electrical Exhibition, which he attended, will remember him as a gentleman of intellect and refinement, as well as of very agreeable manners. His writings were characterized by great clearness, and his series of articles on the Philadelphia Exhibition were especially marked for the close power of analysis which they exhibited.

The Light Obtained from Incandescent Filaments.

Mr. Bernstein finds from observation made on a number of lamps that the amount of light obtained from an incandescent lamp increases with the third power of the number of watts used; or, expressing this in a different way, the amount of light obtained from carbon at different stages of incandescence increases as the third power of the total energy radiated from the carbon. If λ is the amount of light emitted, measured in standard candles, $V A$ the number of watts required for producing λ, then $\frac{(V A)^3}{\lambda} = K$, in which K has a constant value peculiar to every lamp. It is often useful to know at what candle-power a lamp will work at an expenditure of say n watts per candle, and from this formula we have $V A = n\lambda$, and on substituting this value for $V A$ in the above equation, we have $\lambda = \sqrt{\frac{K}{n^3}}$. The constant K can be determined by making one single measurement at any arbitrary candle-power. The formula may also be put thus: $K = \frac{(C^2 R)^3}{\lambda}$. Within certain limits the resistance of a lamp changes very slightly, and may be considered constant. Therefore it appears that within these limits the quantity of light varies as the sixth power of the current—a fact observed by Mr. Preece and Mr. Kittler. The value of K given by Mr. Bernstein is constant only up to a certain state of incandescence, and is then subject to variations which seem to depend on the style of the lamp. At first the value of K is slightly higher, but it soon reaches a minimum, and then remains practically constant up to a candle-power largely in excess of the normal. The growing increase in the values of K at the highest incandescence may be supposed to be due to a change in the relationship between the energy and light at the highest state of incandescence of the carbon, or that losses of electric energy occur inside the lamp. In the last case the measured value of $V A$ would be in excess of the energy radiated from the carbon, thereby producing an increase in the value of K. Mr. Bernstein is of opinion that such losses do occur.

The Westinghouse Electric Company's Dynamo and Incandescent Lamp.

The name of Westinghouse is so prominently and honorably associated with inventions and developments in the arts and sciences that we are not greatly surprised to have now to mention it in connection with electric lighting; but we must confess to surprise at the rapidity with which the Westinghouse Electric Company has introduced its system within the last three months, and at the boldness with which it has attacked the many serious problems that beset the establishment of central stations for incandescent electric lighting for large areas of supply.

It is natural that the work of a company so strongly backed as this and so amply furnished with the best engineering skill should be watched with close interest, and we are glad, therefore, to present our readers with three illustrations of its dynamo and lamp, in addition to a few particulars of its installations. The dynamo, Figs. 1 and 2, is of a familiar Siemens type, shunt wound, with the armature of unusual elongation. Its internal construction is such that Foucault currents are reduced to a minimum. The rings and insulating portions are put together very solidly, and serve to support the wire in a compact mass, as well as to prevent warping from change of temperature, and to afford ventilation. In the endeavor to keep the internal resistance as low as possible, it has been deemed wise to make the diameter of the armature very small, thus lessening the portion of the coils not acted upon by the field of force and giving to the whole armature its great length. The measurements for the windings have all been made mathematically and have also been subjected to severe practical test and experiment at the Pittsburgh factory. The result is claimed to be an absolute steadiness for con-

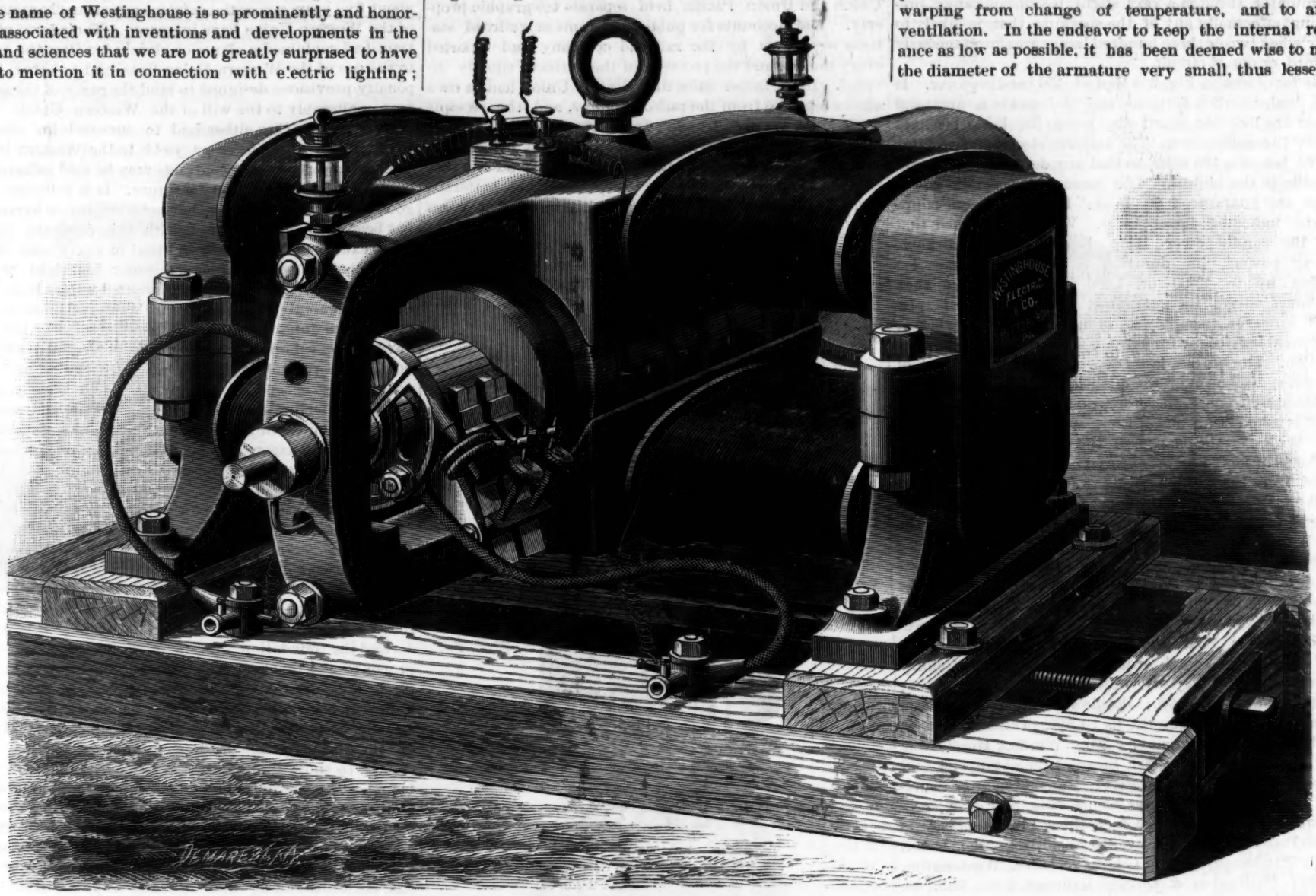


FIG. 1.—FRONT VIEW OF THE WESTINGHOUSE DYNAMO.

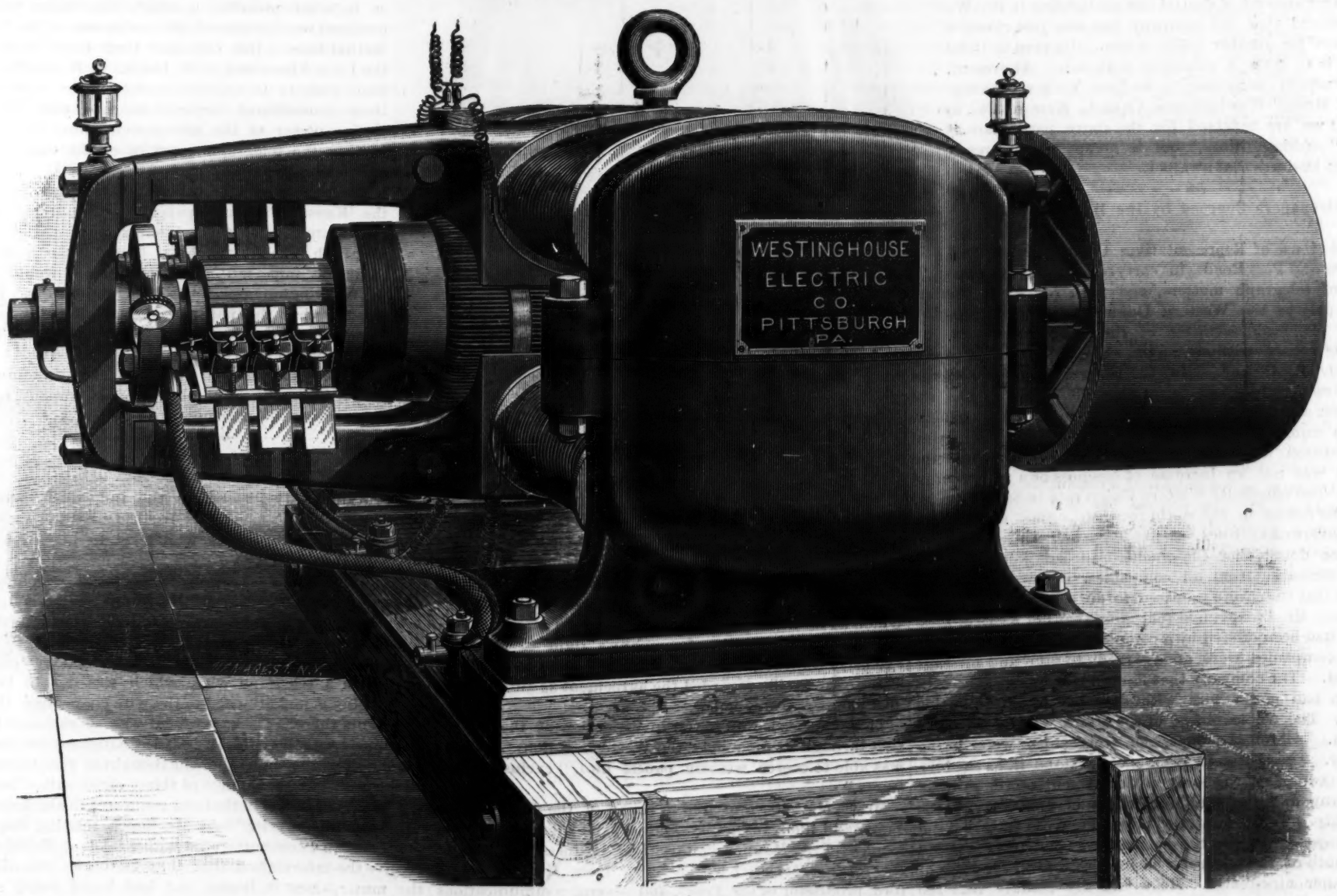


FIG. 2.—END VIEW OF THE WESTINGHOUSE DYNAMO.

stant external resistance, and a constant E. M. F., even when a very large number of lamps are turned on or off suddenly. The brushes are automatically adjusted to the commutator, through a very slight maximum range, preventing effectually any of the sparking that is likely to occur when two or three hundred lamps are simultaneously put into, or out of circuit.

The lamp seen in Fig. 3 is that of 150 candle-power. It has a double carbon filament, and the socket is arranged so that one loop can be cut out, when the lamp becomes of only 75 candle-power. The uniform electromotive force for the lamps is 100 volts, so that any desired changes can be made on the circuit. The standard 16 candle-power lamps are guaranteed 600 hours' life, with seven lamps to the indicated horse-power. We are informed that the 150 candle-power lamp has shown remarkable staying powers, its duration in some instances extending up to 1,500 or 1,600 hours, or more than 300 hours above its guarantee. The company is prepared, however, to supply its lamp as required, whether for normal service, or for great efficiency, or for extreme duration. The life of a lamp depends upon the degree of vacuum as well as upon the qualities of the carbon, and it is interesting to note, therefore, that the vacuum in these lamps is tested by means of the spark from an induction coil. When, on the passage of the spark, a certain shade of color is observed by an experienced eye, the lamp is detached from the pump as ready for use. The bulbs are blown independently of the socket part, that being manufactured in molds. The leading-in wires pass through the joint between the two parts.

The plants installed by the company during the last month or two are as follows: Westinghouse Air Brake Shops, 250 lights; Philadelphia Company, Pittsburgh, 125; Pittsburgh Club, 300; T. C. Jenkins, Pittsburgh, 300; second order, 100; East End Illuminating Company, Liberty, Pa., 500; second order, 500; Allegheny County Electric Light Company, Pittsburgh Station, 2,400; Allegheny Station, 1,600; People's Electric Light and Power Company, Newcastle, Pa., 1,600; Trenton Electric Light and Power Company, 2,200; Windsor Hotel, New York, 400; second order, 200; Steamer "Fishkill," 35, and "Newburgh," 125, Hudson River; James Doak, Philadelphia, 200; Lombard & Ayres, Centreville, N. J., 125; second order, 75; Strawbridge & Clothier, Philadelphia, 25; Pennsylvania Lead Company, Mansfield, Pa., 300; Union Depot, Pittsburgh, 1,000; Gibson & Giles, Washington, Pa., 25; Burlington & Quincy Railroad, Rulo, Neb., 50; Simonds Store, Altoona, Pa., 50; second order, 25; Erie City Iron Works, Erie, Pa., 300; Morrison, Beare & Cass, Tyrone, Pa., 250; Smith Building, New York, 300; Wheeling Steel Works, Benwood, W. Va., 125; Monongahela House, Pittsburgh, 300; second order, 600, as well as others. The most noticeable feature about this list is the large amount of central station lighting in it. We understand that the company has also just closed a contract for another 1,600 station. Its plan in these cases is to make a straight, clean sale. At present, the company, according to its New York representatives, Messrs. Westinghouse, Church, Kerr & Co., to whom we are indebted for the above particulars, is not "pushing things," but is merely getting ready for the business that awaits it.

Newspapers Coerced by the Western Union.

The House of Representatives Committee on Post Offices and Post Roads, in carrying on its investigation of telegraph matters, and with regard to the monopoly by the Western Union Company of railroad telegraph facilities in the West, has heard, among other witnesses, Dr. Norvin Green and Mr. J. J. Dickey. In the course of his evidence Dr. Green, while admitting that his company had the control, said that no competing company offered business. For a number of years the railroad wires were used in competition with the Western Union Company, and the result was not an increase of business or a reduction of rates. The one-dollar Western Union rate to San Francisco was the lowest in the world for the distance, except over the government lines between Paris and Algiers. There was no doubt that the Pacific railroads were bound to take messages from all companies, nor was there any doubt that they were prepared to do so. Their superintendent, Mr. Dickey, had told him that not a single message had been offered by a competing line; that the railroad companies were always ready to take any message offered. The company that figured largest in the investigation had not a wire within 400 miles of the Pacific roads. The whole object of the attack was the Western Union. All of the opposition companies were losing money. The Baltimore & Ohio could stand it, as the telegraph company was only a department of the railroad company, and they could foot a loss of $15,000 or $20,000 monthly. In the matter of rates, the Western Union did not propose to allow those opposition companies that did one-tenth of the telegraph business to control the price of the other nine-tenths. He would say frankly that the Western Union had put up the Mutual Union to compete with the opposition companies in cheap rates. But it was a remarkable fact that the public was not so anxious for cheap service as for good service.

J. J. Dickey, superintendent of the Union Pacific telegraph system and also a Western Union district superintendent, said he was paid by both parties to the contract. Although there was but one superintendent, the Western Union and Union Pacific held separate telegraphic property. The accounts for public telegrams at railroad stations were kept by the railroad company and reported every month, and the proceeds of the business equally divided. In the larger cities the Western Union had its own offices separate from the railroad offices, and the receipts went to the Western Union. In those cities the railroad company maintained separate offices also, but little public business was offered. The railroad company paid all other expenses at their own stations, except for blanks, batteries, etc. The contract provided for a limited number of wires

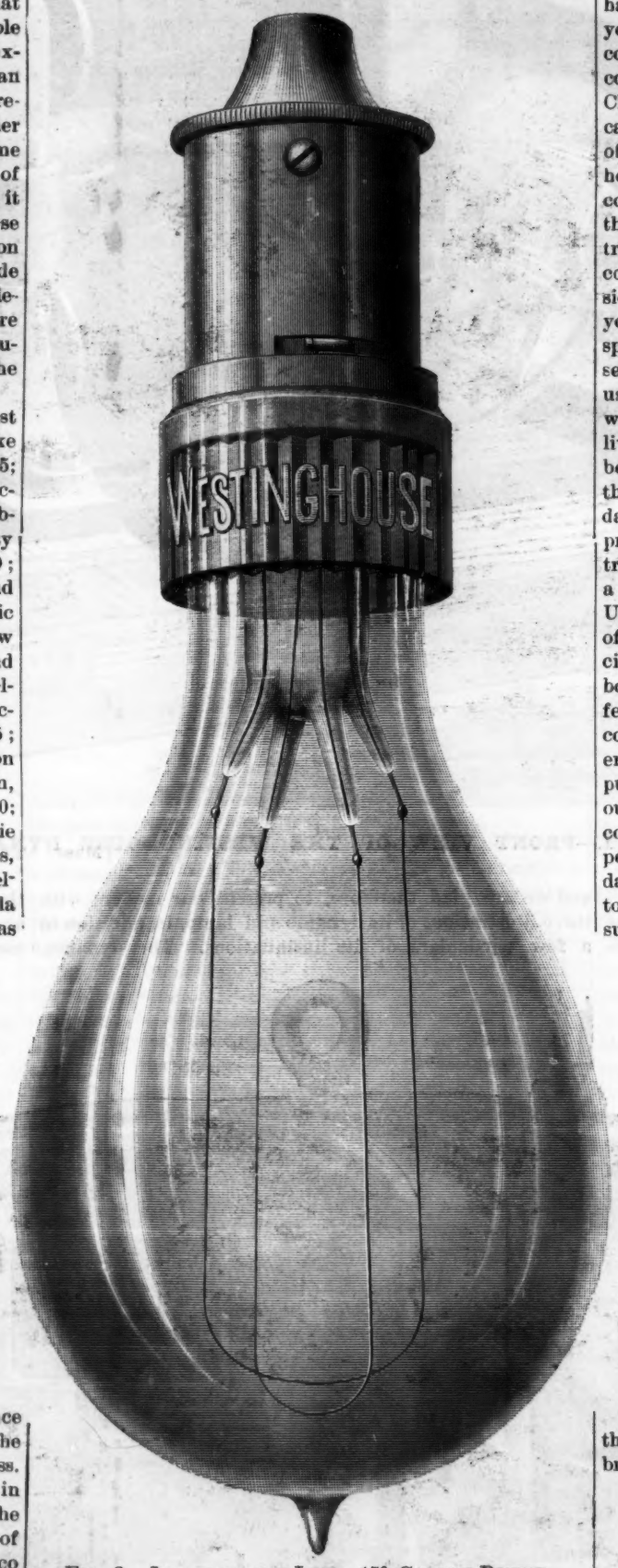


FIG. 3.—INCANDESCENT LAMP, 150 CANDLE POWER.

to be erected at joint expense. Either company could put up additional wires at its own expense. There was a clause in the contract that bound the Union Pacific to give the exclusive preference in its telegraphic business to the Western Union as far as they could legally do so. There was some question about the railroad company's right to make an exclusive contract, and that qualification had been added. The Union Pacific regarded the agreement as an economical business arrangement.

This evidence led up to the investigation of the charge that through its monopoly the Western Union Company was able to coerce western papers into "exclusive contracts."

Mr. E. M. Ayres appeared in behalf of the Kansas City *Times* and the Kansas City *Journal*, and submitted a statement by J. A. Mann, secretary and business manager to the *Journal*, together with a letter from Morrison Munford, proprietor of the *Times*, and several communications that had passed between the latter and the Western Union managers relative to the news contracts of the *Times*. Mr. Mann's statement was read to the committee. Its principal parts are as follows:

"Through a course of years the newspapers of Kansas City have been at the mercy of the Western Union Telegraph Company. With the consolidation of that company and the American Union and Mutual Union companies, about five years since, the extreme measures characteristic of the Western Union have increased. Their form of contract had contained a clause or clauses binding the papers to the use of the Western Union lines, and no other, under penalty provisions designed to bind the party of the second part unalterably to the will of the Western Union. The press of Kansas City either had to succumb for want of adequate news facilities or yield to the Western Union. The acceptance of these contracts may be said to have been made under duress in every instance. It is believed, with good reason, by the writer that not a single rate agreement has been made by any paper with this company in five years except under protest, and that in every one of the contracts the publisher signed away his right to fair competition. Herewith are submitted letters from R. C. Clowry, general manager of the Western Union at Chicago, dated June 7 and 16, 1884, accompanied by the form of contracts submitted, to show the determined effort to hold us to this clause which my predecessor had been compelled to accept. I admit that I had been avoiding this thing, feeling that it had been extorted and was contrary to public policy. Inclosed are documents from the company's manager, complimenting me on my submission, made to save other important franchises. These, your committee will see, follow fast upon each other, and spies in some instances were employed to follow my messenger to learn the sources from which this matter got to us. There were clauses in sundry other contracts by which all were held, provided all others failed. The delivery of even our regular press report was threatened to be withheld by the Western Union if we failed to give the Western Union all our special business. This jeopardized the foundation of our telegraphic service. It is proper to say that we had violated the repugnant contracts only after long and weary efforts to first obtain a fair measure of relief at the hands of the Western Union Company. These papers reveal only a portion of the occurrences of late years, but serve sufficiently to show the network of iron by which we were bound. The committee will note the chief characteristic features of the paper submitted as showing the basis of the contest waged in May and June, 1884. We were threatened that unless we signed these contracts, we should be put upon a higher scale of special rates, practically ruinous, notwithstanding there existed a prohibition in the contract of July 7, 1882, which prevented our use of competing lines in this case. Of course we signed, for we dared not risk our business. If this is not duress, it is kin to it. A year later a modification of this contract was submitted, suspending and abrogating that of 1883, and being somewhat lower in its tariff, it was accepted as, in some measure, a relief. The reason this was tendered was because of the existence of the Pacific Mutual lines in this city, and their connection with the United lines east to St. Louis. It is manifest that some remedy is required to restrain the rapacity of these consolidated corporations, and that the protecting power of the government must step in and perform the telegraphic service of the country, just as it does the mail service."

Mr. Ayres stated, in conclusion, that the purpose of the Kansas City newspapers was simply to inform the committee of their existing relations with the telegraph company, and if it thought the matter of sufficient importance, the proprietors would come to Washington and verify their statements. He requested that the papers be returned, as they would be used in a lawsuit to be instituted against the Western Union Company.

Mr. W. B. Somerville, of New York, superintendent of the Press Division of the Western Union Company, replied briefly to refute the statement read by Mr. Ayres.

The Induction Telegraph.

The Kansas City *Times* gives the following history of Mr. W. W. Smith's accidental discovery of the inductive power between the wires, which led to his method of applying it practically:

"In 1880, while superintendent of the telephone exchange at Indianapolis, Ind., Mr. Smith and others gave a telephonic musical concert to an audience at Knightstown, a distance of thirty-six miles from the scene of the performance. This was done by making telephonic connection with a telegraph wire, which was cut in two at Knightstown, and attached to the wire connecting the instruments there. The experiment was so successful and the music was so distinctly heard at Knightstown that the managers of the entertainment thought to give friends at Richmond, Ind., a distance of thirty-eight miles further, the benefit of it, and to that end connected the broken wire. 'Imagine my surprise,' said Mr. Smith, relating the incident, 'when I communicated with friends at Richmond to receive the information that they had been listening to the music since it began, and had heard every sound plainly. Now, as we had no direct connection by wire with Richmond, I was at first not a little puzzled to know how the sounds had found their way, but a little thought soon satisfied me that it was due to induction, there being eight other wires on the same line of poles." Mr. Smith

did not drop the investigation here as most people would have done, but followed it up, hoping to apply the principle of induction to practical purposes, and with that end in view constructed an apparatus, which he patented in September, 1881." The patent covers the groundwork of Edison's air telegraph.

Reid's "Telegraph in America."

A few weeks ago we were enabled, through the courtesy of Mr. James D. Reid, who allowed us access to the proof-sheets, to give our readers an advance

G. V. B. FROST.

review of his monumental work, "The Telegraph in America," as revised and enlarged in a second edition.* The book has now been issued, and in every way justifies the praise that we have given it. The style of binding, letter-press and of other mechanical features is remarkably good. The pages now number no fewer than 894. There are about threescore fine portraits in steel and wood, and about 70 other miscellaneous illustrations. Our readers can judge of the quality of the work on the wood engravings, from the portraits we have already reproduced, or now present, and the excellence of the steel engravings—nearly thirty—may be inferred from the fact that the cost in some instances ran over $200.

It will be remembered that the first edition came out in 1879. The preface of the volume now before us says: "Since that time many changes have occurred. New men have become prominent, and the use of the telegraph has marvelously widened. Some of its promoters, like its inventor, are dead, and others have become venerable. Meanwhile, with ever-increasing power, the telegraph has become not only the master of commerce, but the tongue of mankind. In all American cities the air is webbed with wires, and iron-footed men still climb through garret windows and up on pole-tops at early dawn to string new electrical integuments across the chimney pots of the sleeping cities. And now it is determined to take the lightning from its native sky and bury it beside the odor-

EDWARD A. LESLIE.

ous sewers under the causeway, there to flash its fires beneath man's dominating foot. In all this there is an interest, familiar, strong, absorbing, and which attaches even to the men engaged in it. For this reason the second edition is issued. It contains much new matter. Like the first, it lays no claim to literary excellence. It is a memorial book, in preparing which the heart has done more than the head Such as it is, the writer presents it as his last token of regard for the great brotherhood of which he was one of the first born, but who now cover the earth." The new matter referred to has, of course, much to do with the later developments, as the first edition has covered all that there was to record up to the time of its appearance. Thus, we find now about fifty pages devoted to the history of the Baltimore & Ohio Company and the other companies that have of late had existence—in some cases sadly brief. The section on the Baltimore & Ohio Company is accompanied by a fine steel engraving of Mr. D. H. Bates, and wood cuts of his leading associates. We take the opportunity to reproduce the portraits of Mr. John E. Zeublin, Mr. Charles Selden and Mr. Edward A. Leslie, all men of marked ability, concerning whom the book gives many interesting details. Another "opposition" corporation, the new United Lines, is represented by Mr. J. H. Emerick, late of the Postal, but now general superintendent of the renovated organization. The other portrait for the use of which we are indebted to Mr. Reid, will be immediately recognized as that of Mr. G. V. B. Frost, who has "by great energy and intelligent devotion greatly added to the efficiency and value" of the American District system. We hear a good deal about the slowness and unreliability of the average messenger, but it is noted in the work under review that the day before last Christmas Mr. Frost had 1,200 boys on duty, who delivered 30,000 packages, not one of which went astray.

It would be hard even to enumerate the various subjects brought under careful notice in the work. Such titles of chapters as these: "Press and Telegraph." "Telegraph Builders," "Telegraphs in Cities," "Private Telegraph Lines," indicate the wide and comprehensive range of the contents.

It has been intimated already that the edition is limited to 1,000 copies, at the price, in cloth, of $5, the first 200 in Russia being furnished at the same rate. Mr. Reid is practically his own publisher, but on the most favorable

CHARLES SELDEN.

calculation does not seem likely to realize the financial return that is his due for the compilation and authorship of the book. He may rest in the consolation, however, that he has done something that will cause his name to be remembered, even had he not been a friend of Morse and the first telegraph superintendent the world ever saw. We are glad to hear from Mr. Reid that the orders for his book are pouring in upon him so rapidly that in all likelihood the edition will be more quickly exhausted than was the first. It is pleasant to know that those engaged in telegraphy as well as a great many others in the later growths of electrical application, are so appreciative of a good work nobly done.

* ELECTRICAL WORLD, February 27.

Operations of the American Electric Manufacturing Company.

It appears from particulars recently gathered by a daily contemporary that the above company is very actively occupied in furnishing its apparatus for plants in all parts of the country. The Badger Electric Company, of Milwaukee, Wis., has already been furnished a 100-light plant by the American Company, which is the first installment of what will be when completed a 600-light plant. This company has a capital stock of $200,000, of which amount over one-quarter has been taken by the widely known engine builders of Milwaukee, Messrs. E. P. Allis & Co., who will equip the factory with steam power, including their celebrated Reynolds-Corliss engines. The steam plant of the electric light company's factory in Milwaukee will cost $40,000, and Mr. Allis, when in New York recently, said it would be, when finished, one of the most complete electric lighting steam plants in the world. The apparatus for the remaining 500 lights will be supplied by the American Company as rapidly as possible, and it is expected to be filled and the station completed by July 1 next. The station of the Milwaukee Company, now in process of construction, is of brick, three stories in height, and when finished is expected to be the most complete in detail of any in that section of the country. A contract has been made by the American Company with the newly-formed American Illuminating Company, of Paterson, N. J., to supply it with a 200-light plant as soon as the apparatus can be delivered. The American Edison Electric Light Company, of Jacksonville, Fla., has put in a new plant, consisting of a 50-light machine and other apparatus of the American Company. The Badger Electric Light Company, of Chicago, has recently put in a 100-light plant of the American Company to displace the same number of other lights used by the company, and the American has a contract with the company to increase the number of its lights to 1,000

J. H. EMERICK.

capacity as quickly as the apparatus can be furnished. This company has recently acquired a site, 100 × 134, in the central part of the city, and is now preparing to erect a three-story brick building covering the entire ground for a central station. It will be equipped with steam plant sufficient to operate 2,500 to 3,000 arc lights, with ample room for an incandescent plant. The Joliet Electric Light Company, of Joliet, Ill., have ordered 125 lights to add to their present American plant.

It is stated also that a 50-light American machine and lamps have been put in use by the Saratoga Electric Light Company, which has given a second order of the same extent. The Electric Lighting Company of East Boston, Mass., has taken a 50-light machine and contracted for another. A 200-light plant has been ordered by the Merchants' Electric Light and Power Company, of Boston, and the Poughkeepsie, N. Y., Electric Light and Power Company has taken a 50-light plant. The Brookline, Mass., Electric Light Company and the Consolidated Electric Light Company, of Portland, Me., both contemplate adding American apparatus to their plants. A 10-light machine and lamps have gone to the factory of the Carew Manufacturing Company, at South Hadley Falls, Mass. The American Company is also preparing to fill large

JOHN E. ZEUBLIN.

orders for plant in connection with its sub-companies recently formed in this State.

Incandescent Lights at the New York Flower Show.—Probably the most attractive feature of the great flower show last week at the Metropolitan Opera House was the fountain around which were placed 1,000 2 c. p. Edison lamps. There have been heard many enthusiastic expressions of approval from persons not connected with the business of electric lighting, as well as from many who are. The wiring for the work was done by Noll Brothers, of 65 Fifth avenue, who certainly deserve great credit for the neatness with which they carried it out.

A Costly Western Union Blunder.

On the 31st of July, 1884, Thomas W. Pearsall, a member of the firm of Thomas W. Pearsall & Co., brokers, while stopping at Great Neck, L. I., sent, through an operator of the Western Union Telegraph Company at the railroad station, a message to Thomas W. Pearsall & Co., as follows: "Buy me 1,000 Western Union stock." The message was not written on a Western Union blank, but on an ordinary piece of paper. The operator neglected to put in the "& Co.," and the message was left upon the desk of Mr. Pearsall, where it remained until the following day, when he returned to the city. In the meantime, Western Union stock advanced, and Mr. Pearsall claimed to have lost $1,700 in consequence of the mistake of the operator. He sued the company in the Supreme Court to recover the sum. The company defended the suit, claiming that Mr. Pearsall, as a stockholder, should have been familiar with its rules, and should have had the message repeated. Upon the first trial of the case before Judge Van Vorst the jury disagreed. On March 23 the second trial was concluded before Judge Barrett and a jury, who gave Mr. Pearsall a verdict for $1,757.

The "Aurora" Battery.

One of the most encouraging signs of the activity in the field of electricity is the impetus which has been given to

FIG. 1.—THE AURORA BATTERY.

the production of primary batteries for various purposes, and especially for that of domestic electric lighting. One of the latest forms of these is the "Aurora" battery of the Stout-Meadowcroft Company, of this city. As will be seen in the illustration, Fig. 1, the battery consists of a gallon glass jar in which are placed two plates of carbon, connected together. Between these plates of carbon is placed a porous cup of special form, which contains the zinc, shown in Fig. 2. The solution used in the battery is said to maintain the action of the battery for weeks, and

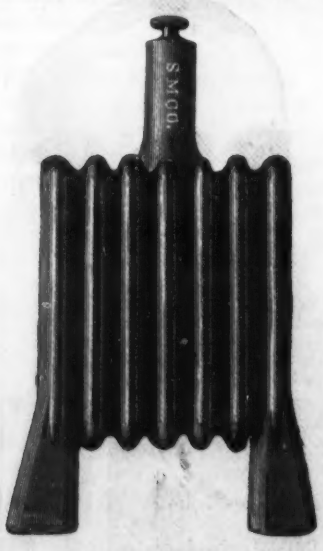


FIG. 2.—ZINC OF AURORA BATTERY.

thus makes it convenient for dentists, physicians, etc. Its electromotive force is 2.2 volts, and it gives a current of 6 ampères.

The Inter-State Telephone Company.

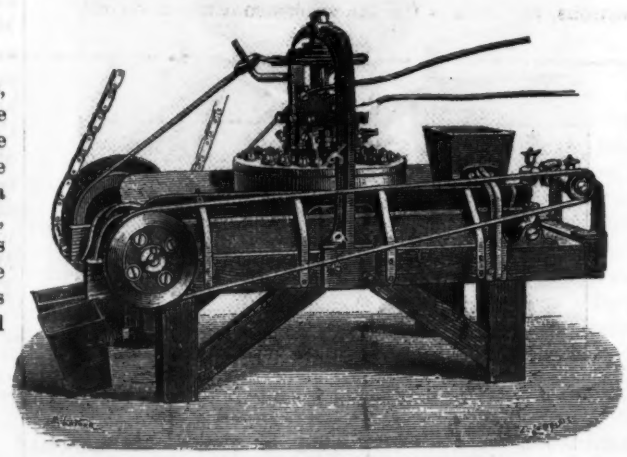
Two years ago there was organized in Chicago a company named the Inter-State Telephone Company, whose purpose was to control the introduction and operation throughout the United States of the Inter-State telephone, an instrument developed from a series of patents made by Geo. M. Hopkins. The patents bear various dates, from 1882 to 1886. Early in February a company was established for operating this new instrument in Michigan, the Chicago company being a parent and controlling corporation. Similar companies have been established in Georgia, Minnesota, Iowa, Colorado, Ohio and other States. The Michigan company has for its officers the following gentlemen: President, I. M. Weston; secretary and general manager, F. V. Taylor; treasurer, Geo. Holbrook. In a brief interview with Mr. Taylor, that gentleman said to a reporter of the Grand Rapids *Democrat* on March 20:

"It is our intention as soon as possible to begin active operations in this State. We intend to locate central offices in each prominent city and village, and connect them with lines. As to the merits of the instrument, I can say that I witnessed a test in this city about two years ago, when a loop extending to Big Rapids and back was used as a continuous wire. The result was highly satisfactory. I also witnessed a test between Chicago and Milwaukee over the wires of the Board of Trade, which proved the instrument to be successful. I have heard of a trial between New York and Chicago. Those who made the test say that the voices were as audible and intelligible as if the talkers were in separate rooms in some block using an ordinary 'phone. The wires of the Postal Telegraph Company were used. Of course each company thinks it has the best 'phone, so we say it. Our prices will be materially cheaper than those paid for telephones now."

An Electric Separator for Machine-Shop Turnings and Ores.

In the majority of machine shops in which brass and iron are worked, the turnings and chippings of both become mixed so as to reduce considerably the value of the former for further remelting. A convenient method of separation is evidently made possible on account of the varying magnetic properties of the two metals, and among the latest machines designed for the purpose was one shown at the late London Inventions Exhibition. Our illustration, taken from *La Lumière Electrique*, shows the machine in perspective. The mixed turnings are thrown into a large hopper, are thoroughly mixed by an automatic agitator, and are deposited in a thin layer upon an endless belt. The latter brings them under a horizontal revolving disc, which carries a large number of electro-magnets, the lower ends of which very nearly touch the surface of the endless belt. The width of the belt is only one-half the diameter of the disc, and a commutator on the shaft is so arranged that only those electro-magnets which are directly over the belt are energized, the others being out of the electric circuit.

It is evident that the energized electro-magnets attract all the iron particles during a part of their revolution, but as soon as they pass beyond the width of the belt they lose their magnetism, and the iron particles fall upon another



NEW MAGNETIC ORE SEPARATOR.

belt, which carries them to a receptacle provided for the purpose, and shown at the left in the figure. The brass or other non-ferruginous particles remain undisturbed, are carried along by the belt and fall into the other receptacle at the end. An apparatus similar to the one we have just described, having a disc 4½ feet in diameter, is capable of separating two tons of turnings or of mineral per day.

In another form of separator, invented by H. Kessler, of Oberlahnstein, a revolving cast-iron drum forms a permanent magnet, being energized by two coils wound on its circumference.

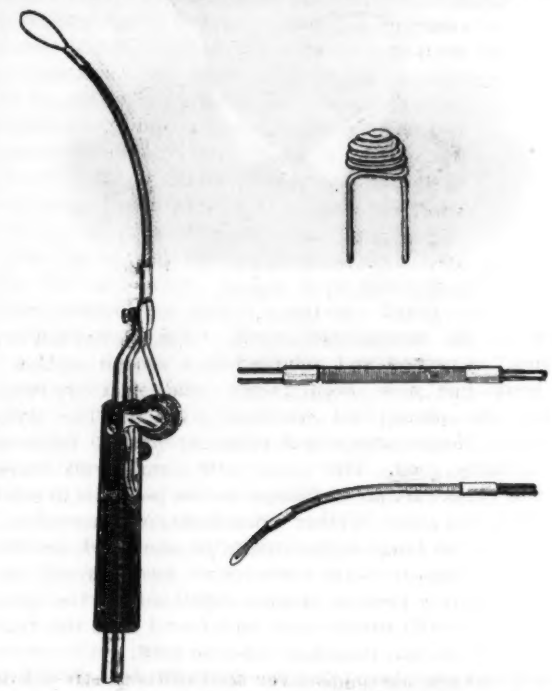
The Contemplated Change in the New York Electrical Society.

At the last meeting of this society, held on March 24, a long discusion took place relative to the proposed annexation of the society to the American Institute, as an electrical section. The Secretary read the communication addressed by Dr. Van der Weyde to the trustees of the American Institute, asking upon what terms the society would be admitted. The reply of the trustees was, in substance, that the society would be admitted as a body, that the members would have all the privileges of the large library and reading-room, and the right to take part in all discussions, but unless they also became members of the American Institute, they should have no vote, and would not be eligible to office. If they became members, however, they would enjoy full rights including a season ticket to the American Institute annual fair, and 25 extra admission tickets. The general impression of the members present seemed to indicate that they were in favor of making the change, as it would bring large benefits, and would not entail any serious burdens. A vote was then taken and it was unanimously agreed to accept the offer of the American Institute. Final action was postponed on account of necessity for changing the constitution so as to permit of the step being taken.

There is not the slightest doubt that the change will be a most beneficial one and will serve to strengthen the society as well as to extend its usefulness.

Membership in the American Institute entails an initiation fee of $10, and annual dues of $5. The annexation will relieve the society of all expenses for rent, etc., and will place a large library and lecture room at the disposal of the members. Hence any dues collected from the members can be used for the purpose of acquiring suitable apparatus for experiment and demonstration, of which the society is sadly in need. The society in addition may appeal to the general fund of the Institute for means in case of necessity, and thus has presented an avenue out of all difficulty. At the meeting a number of members handed in their names for proposal to membership in the American Institute.

The Jones prize of twenty dollars for the best paper read during the last season was also the subject of discussion. Mr. Frank W. Jones, the donor, having declined to be one of the judges of award, Mr. Jos. Wetzler was appointed



FIGS. 1, 2, 3, 4.—NEW ELECTRO-CAUTERY APPARATUS.

in his place. Mr. E. L. Bradley was also appointed in place of an absent member, and these, together with Dr. Van der Weyde, will shortly meet for a consideration of the business intrusted to their care.

Medical Battery for Electric Light and Cautery.

The physician of to-day may be said to be as much in need of the small incandescent lamp and battery and cautery instruments as the physician of old was in need of the lancet; and there is abundant effort to meet the want. Our illustration, Fig. 5, shows the arrangement adopted by the Galvano-Faradic Manufacturing Company, of this city. The apparatus includes a battery designed so as to furnish current for an extended time. It can be used not

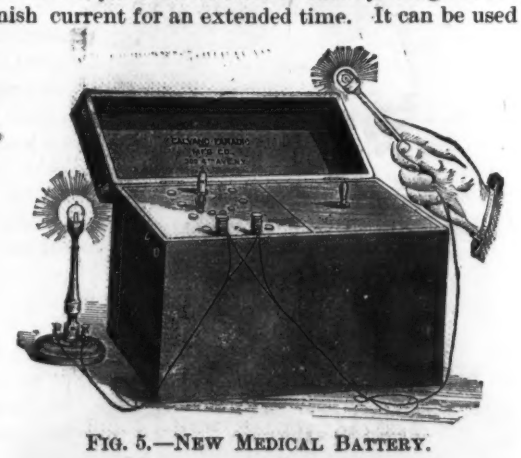


FIG. 5.—NEW MEDICAL BATTERY.

only for generating current for the small lamp, but also for the electro-cautery. The various forms of the latter are shown in the illustrations, Figs. 1, 2, 3 and 4, which represent respectively the knife, point, dome and *ecraseur* used by the physician. The apparatus is made in two sizes, containing four and six cells respectively, so that a lamp for one-half to six candle-power can be employed.

REVIEWS OF NEW BOOKS.

FORMULAIRE PRATIQUE DE L'ELECTRICIEN. 4TH YEAR, 1886. By E. Hospitalier. Paris, 1886. 312 pp., 12mo. Price $2.

Although not in the pocket-book shape, this little volume partakes of the nature of that style of publications. It gives in condensed form a large number of electrical rules, tables, and much information on electrical matters not usually found in such books. The book is brought down to the present year, so that it has additional value in this age of rapid progress from being fully up to date.

Methods of Street Lighting in Minneapolis.

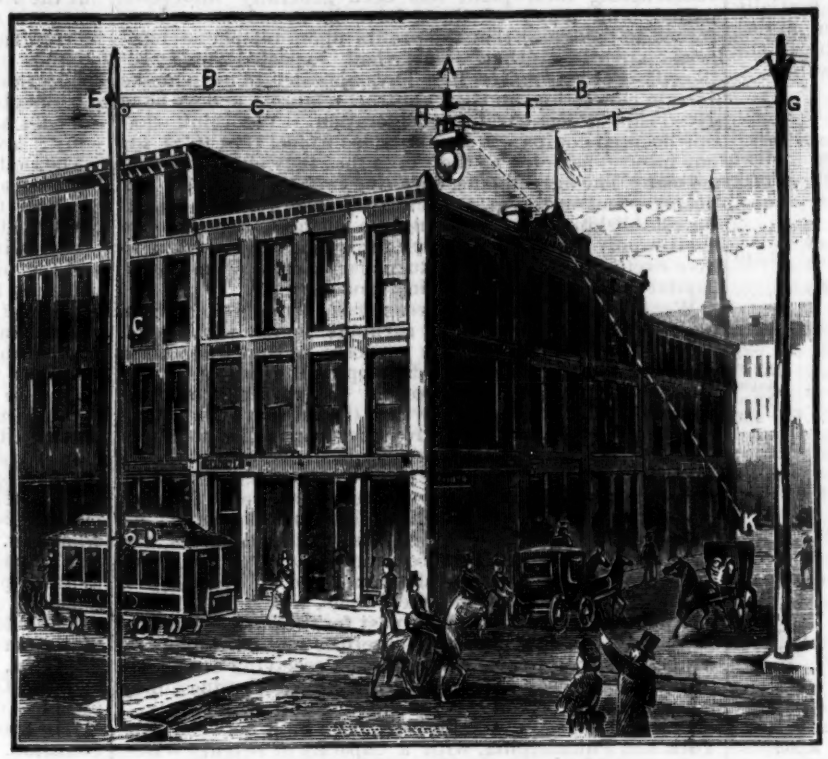
At the recent meeting of the National Electric Light Association in Baltimore, Mr. T. S. King, of Minneapolis, the Secretary of the Minnesota Brush Electric Company, interested the members greatly with a description of the manner in which his city is lighted. We have now obtained fuller particulars. It will be remembered that Mr. King made special reference to the Travis patent hanger used in Minneapolis for suspending the arc lamps at street intersections. Herewith is an illustration of the manner in which it is employed. The ordinary line poles are utilized as supports and are all that are required. The carriage from which the lamp hangs travels horizontally on the upper wire, the lamp descends at an angle of forty-five degrees when lowered for trimming or repairs, and when down is near the street corner, or curb, and out of the way of all passing vehicles. When up to its full height the lamp has a double support, viz., the upper wire, and the galvanized steel wire rope, which serves the double purpose of insuring the lamp from falling and prevents it from swaying in the wind. When long spans are to be made this hanger can be so threaded as to cause the lamp to travel two feet laterally while descending one foot. The lamp can be lowered and raised with perfect ease and safety while burning, if desired, and the perfect working of the carriage is not interfered with by snow or sleet. All bearings have hardened steel journals.

In the cut the references are as follows: *A*, double-sheave pulley; *B B*, No. 4 telegraph wire on which pulley *A* travels; *C C*, ¼ inch galvanized wire cable, used for raising and lowering lamp; *D*, winding drum, from which cable runs through pulley *E* to *A*; *F* is ¼ inch galvanized wire cable, fast to pole *G*, running over the lower pulley in sheave *A* to hard wood round, or "spreader" *H*, from which lamp is suspended; *I* are the circuit wires to lamp, securely fastened to round *H*; *K* is the position of lamp when lowered for trimming.

The Minnesota Brush Electric Company have, during the last year, been operating 225 public lights in Minneapolis, suspended over the centre of street intersections, by means of the system above described, and it has worked to the company's entire satisfaction, giving them no trouble whatever. The company consider it an especially convenient and desirable method, since the streets in each of the four directions get the full and unobstructed benefit of the light on roadways as well as sidewalks.

In addition to enjoying the public lights above mentioned, Minneapolis is adorned by a tubular iron mast, 257 feet high, located on the public square near the Union depot, suspension bridge, etc., and surmounted by eight Brush lights of 4,000 candle-power each, operated by the same company, whose lighting station is 60 × 140 feet, of brick, and has dynamo capacity for 600 arc lights, four-fifths of which are in use. Steam power is used, the power plant consisting of three Reynolds-Corliss condensing engines, aggregating 700 horse-power.

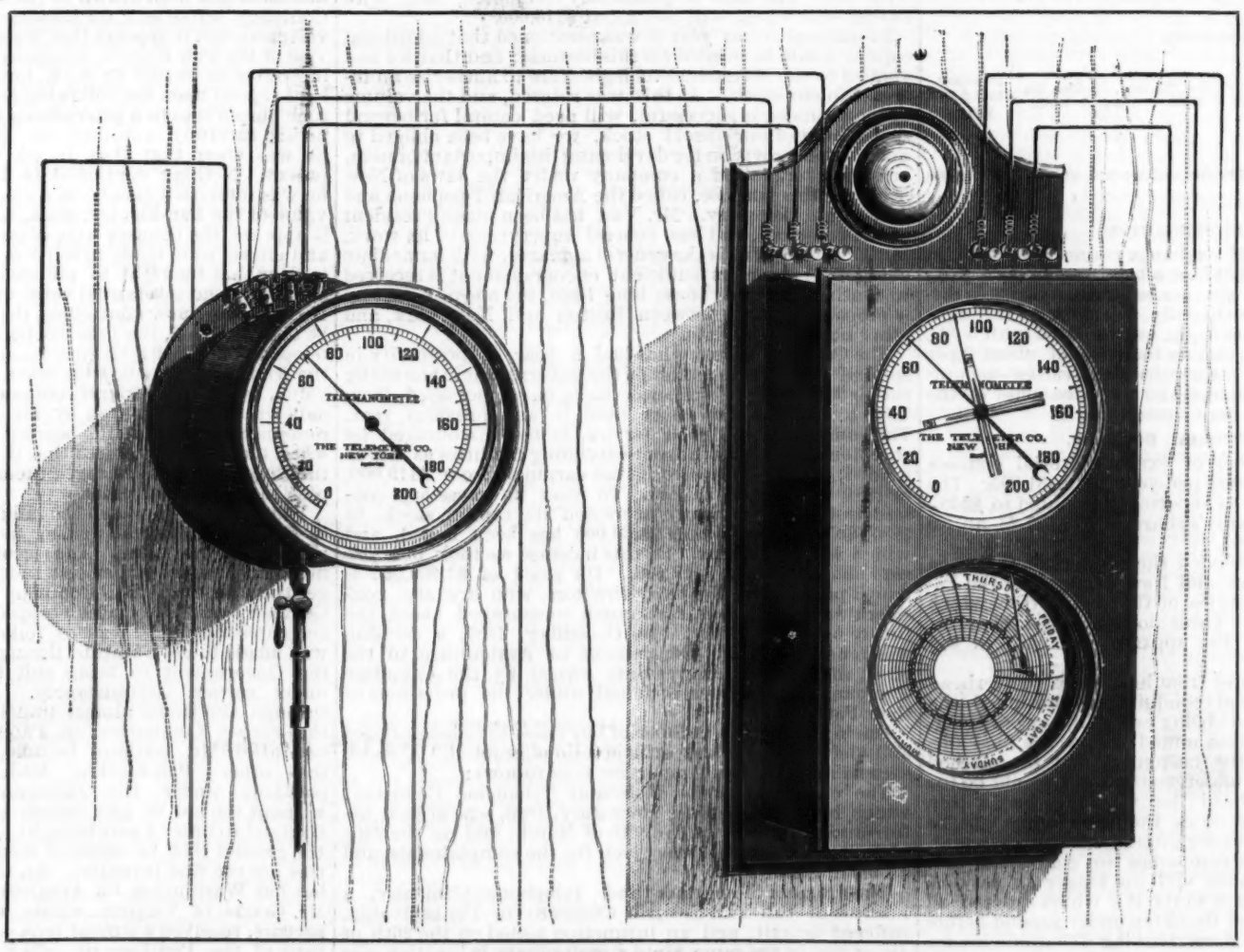
It is worthy of note that when this company was organized and began business in Minneapolis, less than four years ago, the city was under the thumb of a good, solid gas monopoly, holding an exclusive gas franchise, having forty or fifty years yet to run. Gas was costing the city $36 per post per annum, on the street, and to private parties was $3.50 per thousand. Naturally enough the gas company endeavored to keep the electric light out of Minneapolis, but failed in its efforts, and as the result of competition with electricity, the citizens of Minneapolis are now paying but $1.80 for gas, while the city can have as much gas as it cares to burn on the streets at $15.63 per post. The electric light has proven itself a public benefactor in Minneapolis.



STREET LIGHTING IN MINNEAPOLIS.

Improvements in the Telemeter System.

It is now a year since we described the telemeter system of Messrs. Clarke and Hewitt. Since that time various modifications have been undertaken by the Telemeter Company relating to details of construction. Thus, in the older form of recording instrument, illustrated in our issue of March 7, 1885, the record was inscribed upon a continuous roll, which was fed forward under the stylus. In the new form the roll is replaced by a circular dial, which suffices for one week's continuous record.



THE TELEMANOMETER.

Our illustration shows the new form of instruments adopted in the telemanometer or pressure gauge. The transmitting instrument, at the left, sends an impulse over the wires at every change of pressure, and the receiving instrument at the right maintains its pointer in exact coincidence with that of the transmitter.

A long arm attached to the pointer spindle marks a permanent record upon the card. The marking point consists of a small pointed tube filled with ink.

The card is revolved by clockwork so that the steam pressure at all times during the week is continuously recorded. The instrument needs to be attended to only once a week for replacing the dial sheet and winding the clock.

Instruments similar in operation to the above for recording temperature, heights of water in reservoirs, the barometric pressure, etc., are made by the Telemeter Company, of this city. They are all applicable in a large variety of situations. They constitute excellent supervisors of the operations of the firemen on steam boilers. For meteorological work, also, they present great advantages and have already been applied to such a purpose.

They are provided with maximum and minimum stops, so that whenever either of these points is reached, the alarm bell attached to the receiver is sounded.

Long-Distance Telephone Lines.

The American Telegraph and Telephone Co., organized for long-distance work, is using some of the largest cables for submarine and underground use ever laid in this country. Its entire cable equipment is of Kerite. The number of crossings between New York and Philadelphia are seven, viz., North River, twice across the Kills, Raritan, Rancocas and Delaware Rivers, and in addition an underground cable across Ridgeway Park, opposite Philadelphia. The conductors in all the cables, with the exception of one series, are composed of three No. 18 B. W. G. copper wires with Kerite insulation, measuring $\frac{9}{32}$ of an inch outside diameter, the submarine cables being armored with eighteen armor wires, each weighing eight hundred and ten pounds to the mile.

One cable throughout the entire series has its conductors, which are seven in number, composed of three No. 16 B. W. G. copper wires stranded together, equal in weight to two hundred and ten pounds of copper to the mile, and insulated with Kerite to an outside diameter of $\frac{11}{32}$ of an inch. These in turn are taped, laid up and sewed with packing to receive nineteen No. 3 B. W. G. galvanized iron armor wires, weighing nine hundred and fifty pounds to the mile. The entire series of cables are four in number, of seven conductors each, making a total of 28 conductors. Conversation over the line is perfect, and this, to a great extent, is due to the low resistance of the conductors and their perfect insulation.

It is satisfactory to know that our home manufacturers are now competing successfully with those abroad as to construction and character of submarine cables, and that even better results, both electrical and mechanical, can now be obtained in this country for both submarine and underground cables.

A Ghostly Call.

A strange story, which has about it a flavor of the supernatural, is reported from a house in Pynchon street, Springfield, Mass. A gentleman living there, John Clemmens by name, has been seriously ill for several days. On March 23 City Physician Rice received a telephone call which said: "John Clemmens is worse; come at once to No. 43 Pynchon street." Dr. Rice at once responded, when to his surprise and that of the family it was found that no one could tell from whence came the mysterious call. The strangest part of the affair is that Mr. Clemmens had just had a paralytic stroke and that none of the family, so far as known, had been out of the house since the stroke happened. Dr. Rice, who has been attending Mr. Clemmens during his illness, was not surprised at the telephonic call, but it is not known who sent it. The Spiritualists of the city, who have discussed the matter ever since, are only too ready to attribute the telephonic call to supernatural agencies.

Annual Report of the American Bell Telephone Company.

The following is the sixth annual report of the Directors of the American Bell Telephone Company for the year ending Dec. 31, 1885, read at the annual meeting at Boston, March 30, 1886:

The year ending Dec. 31, 1885, has not been marked by the increase of business of previous years; but although there has been a loss of subscribers in exchanges at certain points, on the whole the licensed companies have more than held their own, the total number of subscribers showing an increase of 2,969, and of telephones in use of 4,466 during the year.

The comparative statistics which follow are substantially accurate; but, as usual, we are prevented from giving figures with the precision which would be possible if the entire telephone system were managed by us directly:

EXCHANGES.

	1883.	1884.	1885.	1886	Dec. from 1885.	Incr. over 1885.
Exchanges	725	906	764	752	12	.....
Branch offices	345	419	481	432	40	.....
Miles of wire on poles	.....	.....	88,481	100,630	.....	12,149
do. on buildings	.....	.....	11,886	10,049	1,837	.....
Miles of wire underground	.....	.....	1,225	3,428	.....	2,203
Miles of wire submarine	.....	.....	.....	264	.....	264
Total miles of wire	68,571	85,896	101,592	114 371	.....	12,779
Total circuits	74,484	97,422	107,268	110,967	.....	3 699
Total subscribers	97, 28	123,625	134,601	137,57	.....	2,969
Total employes	3,716	4,702	5,16	5,344	.....	182

UNDERGROUND WIRES.

	Miles of wire underground 1885.	Miles of wire underground, 1886.	Increase over 1885.
Washington	770	992	222
Chicago	....	760	760
New York	....	627	627
Pittsburgh	223	614	391
Boston	232	289	57
Brooklyn	....	134	134
Baltimore	....	11	11
Milwaukee	....	1	1
	1,225	3,428	2,203

EXTRA-TERRITORIAL LINES.

	Jan. 1, 1883.	Jan. 1, 1884.	Jan. 1, 1885.	Jan. 1, 1886.	Increase during 1885.
Number of lines	247	598	826	931	105
Miles of pole lines	6,154	20,592	25,766	31,395	5,629
Miles of wire	13,653	29,359	35,631	42,461	6,820

INSTRUMENTS.

	Dec. 20, 1882.	Dec. 20, 1883.	Dec. 20, 1884.	Dec. 20, 1885.	Increase during the year.
In hands of licensees, under rentals	237,728	298,580	325,574	330,040	4,466

EXCHANGE CONNECTIONS.

The estimated number of exchange connections daily in the United States is 746,517, or a total per year of 272,478,705. The number of calls per subscriber varies in different exchanges from 2 to 10 daily, the average throughout the United States being 5 $\frac{43}{100}$, as compared with 5 $\frac{18}{100}$, the number reported last year, an increase of about 5 per cent. The average cost to the subscriber varies—according to the size of the exchange and the character of the service—from 2 to 7 cents per connection.

EXTRA-TERRITORIAL BUSINESS.

The average daily number of extra-territorial connections is 6,663, or total number per year of 2,431,995. The extra-territorial earnings, as reported, amounted to $538,740.43, of which this company's share is $72,677.28, an increase over 1884 of $5,411.63.

Last year's statement included the connections between exchanges of the New York and New Jersey, and the Pacific Bell and Sunset companies, on the receipts from which we receive no percentage. These do not appear this year, which will account for the apparent decrease in the number of connections.

The removal of open wires from house-tops to overhead cables and to underground conduits has continued, the progress in the latter respect being especially encouraging. The system must always be a mixed one, as the final distribution of the wires to the customers, and the method of reaching places where underground work would be too costly, must still be overhead; but we think that, within a few years, in all large cities the open wires will be placed in cables above or under ground to such an extent, at least so far as telephone companies are concerned, that the overhead wire nuisance will no longer be serious. In New York an amendment to the law which ordered all wires in New York city and Brooklyn under ground before last November, was adopted, establishing a Commission for each of these cities with power to supervise the execution of the law, and to arrange for placing the wires underground to such an extent as might be found practicable. In Brooklyn the Commission has permitted the wire companies to begin their work, and one hundred and thirty-four miles of underground wire have been placed there by the Telephone Company. In New York the Metropolitan Company, in August, 1885, filed with the Commission the necessary plans and statements for an underground system, and applied for permission to prosecute the work, but so far without success, and this work in that city is at present at a standstill.

The treasurer's statement to December 31, 1885, shows gross earnings for the year, from all sources of		$2,765,884 93
Expenses		972,688.45
Net earnings		$1,793,196.48
Miscellaneous credits		16,800.00
Total		$1,809,196.48
Regular dividends paid	$1,170,192.00	
Extra dividends paid	392,044.00	
Total	$1,562,236.00	
Reserve written off for depreciation of instruments	100,752.90	
		$1,662,988.90
Balance to surplus account		$147,007.58
Total surplus to date		$1,204,120.01

We have received during the year in stock of licensed companies $516,316.67, of which $207,200 was for licenses and the rest for cash, and have sold $29,681. We have received during the year in dividends from licensed companies $597,469.99, an increase of about $122,000 over the previous year. With longer experience the telephone companies have learned that the cost of maintaining and reconstructing their plant has been generally underestimated, and many of them have in consequence been forced to recognize that the profits upon telephone business are less than they had expected and believed. For this reason they have appealed to us to make certain concessions in their contract relations, and we have given this subject careful consideration. We think that our licensed companies should be led to feel that it is for our interest as much as their own that they should be successful. The agreements, speaking broadly, between our licensees and ourselves, are that they shall furnish capital for establishing and developing the business, and that we shall supply the patents, which for a time are expected to give exclusive rights, and returns large enough to invite capital to an industry involving unusual risks.

We have met our licensees; *first*, by agreeing, when desired, that our share of net earnings, jointly with theirs, may be used for construction purposes, so that we in these cases are sharing the cost of developing the business; *second*, we have made a reduction in the royalties on telephones used in small places where the rates are low. This reduction involves a loss of royalty amounting to about $200,000 per annum on our present business, offset, as we believe, by keeping more telephones in use than would be under the old rates, and it gives relief where it is most needed. In the case of the New England Company, we have made substantial concessions to the licensees, and have agreed to amend their contract so as to provide for future construction, and at the same time to enable dividends to be paid from the net earnings, which have necessarily been used for some time past for the purposes of construction; and we are now carefully maturing plans by which those companies which are not receiving a fair return upon the cash actually invested in the business may no longer be deprived of an income upon their property.

During the year a pole line has been built between New York and Philadelphia, with a capacity of seventy wires, and twenty-four copper wires placed upon them, various sizes being taken for purposes of experiment. Some difficulty has been found in securing rights of way for this line. Sufficient facilities are not yet secured in Philadelphia for reaching customers there, but it is expected that this will soon be accomplished, so that the question of commercial demand between two large cities a hundred miles apart will presently have a fair test. The Metropolitan Company, of New York, pays for and owns over one-half of this line, and will divide the expenses and receipts with us. The line is practically completed, and, with twenty-five wires, will cost about $215,000.

In our report last year it was mentioned that additional capital would be needed for this business; and that we had applied to the Massachusetts legislature to authorize an increase in our stock. As this was refused, and the volume of the business, if successful, will need capital far beyond the amount of our unsold stock, we have been obliged to make other provision for developing this important branch, and have organized a company under the laws of New York for this purpose, called the American Telephone and Telegraph Company. Mr. Vail has been made President of the company, and has general supervision of its work. Mr. E. J. Hall, Jr., is the general manager, with immediate charge. As soon as sufficient encouragement is received to continue building these long lines, the above company is prepared to build between Boston and New York, and other important points.

The Canada Company has had a year of prosperity in spite of the adverse action of the government in annulling the Bell patents. Their subscribers have increased from 7,418 to 9,614, in fact more than in any previous year. The company gives good service, is not discouraged by threatening legislation from extending facilities as fast as needed, and has increased its net earnings from $119,000, in 1884, to $158,000, in 1885. To meet its necessary construction, this company increased its capital stock, in 1885, $250,000, of which $200,000 has been issued, and which was sold at par. Of this increase we took our *pro rata* share, namely, $117,500. Its stock of $1,200,000 is worth par, and its Montreal directors, who are also considerable stockholders, feel much encouraged about the future of the company. In December, 1885, a decision was rendered by the Department of Agriculture, to the effect that the Edison patents owned by the Canadian Company had not been forfeited under the provisions of their Patent Act.

During the year a number of our cases have been argued and decisions reached or injunctions granted. A short statement of the most important is as follows:

The case against the Molecular Telephone Company, which has been pending since July, 1883, was argued before Judge Wallace on the 30th of March, and on the 24th of June a final decree was given for the complainants, and an injunction issued.

The Rogers Telegraph and Telephone Company, a licensee of the Pan-Electric Company in Pennsylvania, suffered default, and an injunction issued on the 26th of June; and in the same State a preliminary injunction was granted, after full hearing before Judges McKennan and Atchison, on the 8th of July, in the case of the Western Pennsylvania Telephone and Telegraph Company, a licensee of the National Improved Company, and final decree was made and injunction issued in December following.

On July 16, a bill was filed in Baltimore against the Pan-Electric Company and its licensees in that city and in Washton, and on Sept. 15 the court refused to grant delay, and issued a restraining order until the case could be heard.

The case against the People's Telephone and Telegraph Company, using the Hopkins instruments, was finally argued before Judge Wallace in December, and an injunction was granted the same day. At the same time he heard arguments in the parent Overland case, and at once granted the injunction.

Depending on this last case were suits against various of the Overland sub-companies, and injunctions issued against all of these. This includes the following companies:

Overland Company, of New Jersey; Penn. Overland Company; Baxter Overland Company, of Philadelphia; Maryland Overland Company; Indiana Overland Company; Baxter Overland Company, of Central New York; and Michigan Overland Company.

In the suit against the Overland Telephone Company of Lexington, Ky., begun Aug. 31, 1885, arguments were heard on Oct. 6, and a preliminary injunction was granted Oct. 8.

The Drawbaugh case was reopened in October by consent, to allow the defendants to put in what they claimed to be newly-discovered evidence, and arguments on this were heard by Judge Wallace, at Syracuse, in December, but the Judge decided that there was nothing in the new matter to alter the views already expressed by him, and he reaffirmed his former decree.

Other injunctions granted during the year were against the McDonough Company on February 14, 1885; New Jersey Telephone Company, using the McDonough claims, on July 10; and the Citizens' Telephone and Telegraph Company (Cleveland, O.) on August 18.

The Dolbear, Drawbaugh, Molecular, Overland and West. Pennsylvania cases are either in or on their way to the Supreme Court, and the Dolbear case is expected to be reached at the October term.

Regarding the proceedings of the Pan-Electric Company and the proposed Government suit, the stockholders will naturally feel much interest, and the facts will be stated somewhat in detail:

The Pan-Electric Telephone Company was organized in 1883, with a capital of $5,000,000, the ostensible basis of value for which was a group of patents, some of which related to telephones, of one Rogers. Its headquarters are in Memphis, Tennessee, which is also the home of Senator Harris and others of its promoters. These patents are perhaps the most palpable infringements upon the Bell patents that any one has yet attempted to rely upon; there is not even the pretense of any invention prior to Bell, and the inventions are of no importance whatever. The company had apparently so litttle to offer that it was for a time difficult to see what they expected to accomplish, either in the establishment of a telephone business, or in starting a legal contest. The principal stockholders were leading politicians in the Southern States, and their operations, so far as the telephone business goes, have been mostly confined to that part of the country. General Joseph E. Johnston, of Virginia, was made president of the company, Senator A. H. Garland, of Arkansas, its attorney, and Senator Harris, of Tennessee, General Johnston, Senator Garland, Casey Young, J. D. C. Atkins, of Tennessee, J. H. Rogers, formerly of Tennessee, now of Washington, D. C., and Robert F. Looney, of Tennessee, its directors. These gentlemen received large blocks of the capital stock, paying nominal sums in money for the same. Sub-companies were formed, from whom bonuses in cash were taken for the right to practice the Rogers inventions in different places, and additional blocks of the stock of these sub-companies appear to have come to the promoters. On Jan. 4, 1884, Mr. Garland was asked for an opinion on the Rogers patents. One D. E. Myers, who said that his attention had been drawn to the stock of the Pan-Electric Company, wrote as if for information upon a matter of investment, but it appears that Myers was himself in the service of the Pan-Electric Company, and was therefore not interested in buying its stock, but in selling it. Mr. Garland replied upon the following day, giving what from its tone purports to be a professional opinion, to the effect that he had carefully examined the Rogers patents, and that he was clear that they in no way infringed the Bell patent. Nothing contained in his letter indicated that he was interested deeply, as a stockholder, in the market value of the Pan-Electric stock. Upon this opinion largely, it appears, the bonuses were obtained from sub-companies and efforts were made to sell Pan-Electric stock. Yet it is clear that the right to practice the Rogers inventions could have no substantial value under any circumstances. If the patents now controlling the telephone business could be declared void, the Pan-Electric would only share the telephone field with all comers, and the rights for which the bonuses and stock were taken are of wholly imaginary value, while Mr. Garland's opinion about the Rogers patents was not shared even by his associates, since it was renounced by them at the hearing before Secretary Lamar, when they squarely stated that if Bell's patents were valid, the Rogers patents infringed them, and they did not propose to contest that point.

The first way in which the influential names were to be used was, therefore, in getting money for supposed rights which had no value. The second was, perhaps, equally ingenious, but, so far, not as successful. It was a plan to get the suits of the Bell Company against the Pan-Electric Company and associates stopped. The programme for accomplishing this was as follows: In 1884 an attempt was made to get a statute through Congress, authorizing the Government to bring suit to have patents vacated under certain circumstances. This measure was got through the House almost unnoticed, but it did not pass the Senate Committee on Patents. This move failed, but after Mr. Garland became Attorney General, and the other Pan-Electric leaders received important positions under the Government, it was decided without the aid of any statute to ask Attorney General Garland to order a suit brought to annul Bell's patents, on the ground that he obtained them by fraud, and that he was not the first inventor. Mr. Garland declined to act, but left Washington for Arkansas, and his next in office, Mr. Goode, of Virginia, within a day or two of his departure, received a similar request from an associate company of the Pan-Electric, called the National Improved Telephone Company of New Orleans, and upon one day's examination decided that there was reason and authority for consenting, and he ordered the suit brought, not in Massachusetts, where our company exists, but in Memphis, Tenn. He further placed in charge of this suit, with authority to proceed in the name of the government, the very man who is the most active manager in the Pan-Electric enterprise, namely, Casey Young, its secretary and treasurer, and Geo. B. Gantt, also a stockholder, and Luke E. Wright, of Memphis, and J. R. Beckwith, of New Orleans. For some reason these men were so confident that the suit would be ordered, that they had a bill all ready (printed beforehand in New Orleans), which was immediately filed in Memphis. As soon as Mr. Goode ordered this government suit, counsel for the Pan Electric appeared in Baltimore before Judge Bond, who was about to hear our application for injunction against that company, and asked for a postponement of proceedings, for

the reason that the government suit was a valid objection to a preliminary injunction, thus exposing the motive of the whole movement. This request was not granted, a restraining order against the Pan-Electric Company was issued and the court will hear the case in due course. The President, finding that Mr. Goode's action had been taken without reference for information to the Department of the Interior, suggested to the Department of Justice, that it would be better to conform to usage in such matters; and the suit was withdrawn. A new request was then preferred and sent to the Department of the Interior for information. The Secretary of the Interior, Mr. Lamar, of Mississippi, gave a hearing, lasting a week, on the question of the government suit, at which Messrs. Dickerson, Smith and Storrow appeared for us. Without considering the merits of the questions involved, he advised that the government had a right to bring such a suit, and also that it should do so, apparently because there was an allegation of fraud involving officers of one of the departments, which, for some reason not explained, he thought could alone effectually be investigated in a suit by the government itself; but he advised that the government should conduct its own case, and at its own expense. On the 1st of February our suit for injunction against the National Improved Company in New Orleans, the associate of the Pan-Electric Company, was reached. Once more the counsel for our opponents appeared, with the request that the case be postponed, because the Secretary of the Interior had advised the government to bring suit against us, and that other cases ought not to be heard until that was decided. It is easy to understand the injury to the Bell interests that would follow if the United States courts should refuse us all protection against infringement until the government could try over again and determine all the questions relating to the priority of the telephone invention, which it has taken us eight years of arduous litigation to bring to their present condition of readiness for the Supreme Court. The court at New Orleans refused to stay proceedings, the arguments have just been heard and we hope for an early injunction in this case. Here, then, the whole programme lies exposed: a plan to sell rights that had no value, on the strength of prominent names; a plan to wreck our property by stopping our suits, pending years of wholly unnecessary litigation; a plan to deceive the public into the belief that the defeat of the Bell patent would confer value upon Pan-Electric stock—a plan to inveigle Mr. Cleveland's administration into support of this scheme. If such a plan can succeed, what interest in this wide country is safe from an infamous attack? If any doubts have existed as to the expediency of a statute permitting such action on the part of the government, the proceedings of the Pan-Electric associates, and the fact that they could secure the aid of such men as Mr. Garland, Mr. Harris and General Johnston, ought to put an end to them. If there is any reason to believe that such power is already within the reach of the government, without a statute, can any one doubt that it should be removed by immediate prohibition from Congress? If the government, upon a simple allegation of fraud in the obtaining of patents or other government grants, made by interested parties, can be called upon to bring suits either at its own expense or under the management of the interested party, to annul its own agreements, any poor inventor may have his fortune wrecked by powerful competitors. Any owner of property based upon government agreements or land or other grants may find the government, on whose faith he has expended his money, appearing before its own courts in favor of some irresponsible or dishonest claimant.

It has been urged that nothing but the annulling of our patent in suit, by the Government itself, would suffice to enable others to enter the telephone field. There is no weight in this, for with every decision in our favor, we have barely been able to keep the field free from serious infringement, and it is certain that one decision by the United States Court invalidating our patent would be enough to flood the country with competing companies. It seemed inconceivable that, upon this state of facts, the essential parts of which were already public, the Government should lend any countenance to such an enterprise. We felt entire confidence that Mr. Lamar would advise that, at least under such circumstances, the two parties interested should be left to fight their battles before the courts in the usual way, and his decision took us wholly by surprise. When he made it public, it seemed proper to place the facts in the case before the President; and the president of your company went to Washington, and had an interview with Mr. Cleveland. The latter was told that the present owners of the Bell patents had bought them in good faith, in the belief, which they still entertained, that they were properly obtained, and were valid; that on the strength of United States patents, and repeated decisions of the United States Courts in their favor, the parent company and its licensees had invested vast sums of money in putting this invention into use throughout the country; that the sum of fifty or sixty millions of dollars were now at stake in the business; that every issue which the Government was asked to raise, was already in the records of several cases that had been argued and passed upon by the United States Courts, which were already far on their way to the Supreme Court, on appeal, and that the first of these cases was expected to come up in October; that we had expended eight years of litigation, involving over fifty days of argument by the ablest counsel we could procure, the taking of over five thousand pages of testimony, and the expenditure of half a million of dollars; that our licensees could not but view with alarm the prospect of going once more over this expensive and tedious road, in the face of a suit brought by the Government at the instance of a company which they believed to be wholly speculative and irresponsible. It was shown that the programme of the Pan-Electric Company was to get our suits stopped, and not tried, and to avail of official influence to get this accomplished, and it was explained how thoroughly our property could be destroyed without trial, could the existing suits be suspended while the Government suit was slowly making its way to a decision. But the Government adheres to the advice of Mr. Lamar, and on the twenty-third day of March filed a bill against this company and our licensees in Ohio, at Columbus, Ohio, before Judge Baxter, who would also have heard the case had it been brought at Memphis. Messrs. Thurman, of Columbus, and Lowery, of New York, with several others, have been selected as counsel, and it is not our belief that the management of the suit is to be left within the control of the Pan-Electric Company, or that the Government intends to allow any unnecessary delay to be interposed in its prosecution. It is to be noted, however, that it has taken this distinguished group of counsel over two months to decide the questions which Mr. Goode disposed of in a single day. While there has undoubtedly been a widespread feeling of anxiety among our stockholders and licensees at finding the power of the Government thrown into the scale before its own courts, under the circumstances just described, our counsel and the directors feel no uneasiness as to the result of such a suit, as all the matters involved have been the subject of repeated decisions.

Regarding the question of locality of a Government suit, we are advised by counsel that jurisdiction can only be had over us in Massachusetts. It is said that Government seeks to find a place where no telephone cases have yet been heard, but if this be true its attitude is not easy to understand. If the subject has already been passed upon, it cannot under established usage be again considered by the Circuit Courts, and if it is new, a court which has already made itself familiar with matters relating to telephone inventions would seem to be the one most likely to give quick and intelligent dispatch to the business. To assume that there is any prejudice in our favor in the various courts before whom our suits have been heard, would be an indictment of a large part of the judiciary by the Executive, for which there can be no justification. Regarding the newspaper agitation that has attended this Pan-Electric exposure, it is proper to say that we have taken no part in it, directly or indirectly. While it would have been wholly within our right to place all the information within our reach in the possession of the press, we felt that having adopted the course of going directly to the Government with the facts as we understood them, it was the proper course, at least under the then existing circumstances, to take no part in any discussion in the newspapers. Yet it has been impossible to avoid a sense of outrage at the whole transaction and the support it has received in official circles, which made it difficult to maintain silence, and we feel that this full statement of the matter is due to the stockholders.

Last summer, Mr. Vail, feeling that a due regard for his health required relief from the arduous duties of general manager, resigned that position, which he had held with great benefit to the company since its formation. Being desirous of availing ourselves of his energy and wide knowledge of the telephone business, we made arrangement with him by which he undertook the general supervision of the American Telephone and Telegraph Company, as president, and the more immediate supervision of the affairs of the New York Company. He will also give such attention to any other of our interests as we may from time to time desire.

Mr. John E. Hudson, who has been with us as counsel for years, accepted the position of general manager and solicitor, and his familiarity with our affairs has enabled us to make a change in management with the least possible inconvenience. Mr. C. J. French, who formerly represented our interests in various of the important Western companies, has been elected assistant-general manager in place of Mr. Madden, who also resigned during the year. Mr. Hudson has, since last September, performed the duties both of general manager and attorney, but this involved altogether too much labor, and Mr. Geo. V. Leverett has lately been retained as attorney and will relieve Mr. Hudson of a large part of the legal work of the office.

The Western Electric Company has been brought into a much better condition than it was in a year ago, the company being free from debt and possessed of a substantial surplus after paying regular dividends of one and a half per cent. per quarter during the year. This condition is due in a great degree to the careful management of Mr. W. S. Smoot, who assumed the presidency of the company in January, 1885, and whose recent death has deprived us of a most faithful, upright and efficient officer.

The laboratory has conducted a large number of experiments in connection with patent litigation. In addition to this, further examination has been made into the matter of underground work and cable systems, and a series of experiments are in progress. Further experiments are also in progress in reference to underground work in connection with overhead systems.

The Patent Division has proceeded with its work of digesting and indexing, for easy reference, patents of the United States and Great Britain relating to electricity, and in bringing forward the history of the development of the telephone system, and in examining and reporting upon the novelty and value of various inventions submitted to the company. This division has also, during the year, prepared specifications and applications for patents for inventions made by employés of the company and others, which have been thought of sufficient value to patent.

Mr. Gilliland resigned his charge of the Mechanical Division about Nov. 1, 1885, and Mr. H. V. Hayes has assumed the position.

The Mechanical Department and Testing Department, heretofore in separate buildings, have been combined and have recently been moved to new quarters, with great gain in the matter of convenience, but without additional expense.

In April, 1885, the State of Indiana passed a law restricting the price of rental of a telephone to $3.00 per month, and $2.50 each, where two are used. This was done against the almost unanimous report of the committee which had examined the subject, and before whom careful testimony had been placed as to the cost of telephone service.

This raised at once two questions of the highest importance to our licensees:

First. The question of the right of the Legislature to make such restrictions.

Second. The question of public policy in respect to such legislation.

A case testing the validity of the law was brought, and carried up to the Supreme Court of Indiana, and the Central Union Company, doing the telephone business of Indiana, gave testimony beyond dispute that telephone service in Indianapolis and other cities actually cost that company more than $3 per month per subscriber. That court has recently decided that the law is valid, but has accompanied this decision by language which implies a doubt whether the law is either wise or just. The court based its opinion largely upon the so-called police power of the State, which is said to confer the right to control matters affecting the safety and convenience of the public, and quoted the case of a restriction enforced against the patent owners of a dangerous oil, in behalf of its position. But there is no question as to public safety involved in the telephone law, and as the telephone is certainly a convenience to the public, of less consequence than the supply of food and clothing, it does not seem probable that the right to regulate the telephone business, even without considering the question of patent right, exists, unless the State has the power to regulate prices of all other commodities. If this general power does exist, surely the patent right must give some protection to a business which wholly depends for its peculiar value upon patented inventions. The court made the distinction that the price for the right to practice the invention could not be interfered with, but that as soon as the invention was embodied in a tangible article like the telephone, the State possessed the right to limit the price for the use of it. This is to assert that the State has only to take one step round, in order to practically accomplish that which the court itself says it must not do, and this whole ground is so opposed to the generally accepted theory upon which patented articles have been bought and put into use, and to the whole theory of the patent law, which purports to insure full protection for the exclusive use of the invention during the life of the patent, that it seems incomprehensible that the view of the Indiana court can be correct. In consequence of this decision the Central Union Company is obliged to close its exchanges in the principal cities and large towns; there seems to be no other course, unless the company is willing to do business at a heavy loss until the rate law can be repealed. The public will necessarily be put to serious inconvenience, and the Telephone Company is helpless to give relief. In Ohio and New Jersey similar bills which were before the legislatures of those States have been rejected or postponed, and we have every confidence that the same result will be reached in several other States, including Massachusetts, where the same legislation has been attempted.

The Indiana case is to be appealed to the United States Supreme Court, and the result will be awaited with anxiety by many others than those interested in telephone property. If the States possess such right as is claimed by the Indiana court, the motive of public policy should still operate against its exercise. Why should the telephone business be regulated as to price more than other industries? The reasons offered are that telephone companies are monopolies, and that they have been granted certain privileges of location, but as they are monopolies only by virtue of the patent system, which is everywhere accepted as a part of our public policy to which all the States are committed, no State in fairness ought to destroy that which this patent system has created, and the privileges of location which have been granted them are so precarious, that sufficient obstacles are already placed in the way of conducting their business, by their being obliged to put their money into plant of such uncertain tenure. Sound public policy is surely against the regulation of the price of any class of commodities by law. If it is admitted with telephones, it may presently be proposed for anything else which the public wants. In the discussion of this matter, the circumstances that these patents are property bought and paid for, seems often to be wholly overlooked by those who are proposing to distribute the benefits of the telephone to the public. It is the buyer using his majority vote to fix prices, without reference to the rights of the seller. It is often asserted that telephone rates are too high, but the assertions are unaccompanied by any proofs, and those who make them do so without that knowledge of the business which is necessary to a fair judgment. As the stockholders generally have not been able to acquaint themselves with these matters, it may not be out of place to say a few words about this question. Had an offer been made in the first place to put a wire, a switch apparatus and operators, day and night, at the service of each subscriber, and to charge not over five cents per connection within usual exchange limits, can it be doubted that such a charge would everywhere have been accepted as moderate? In fact, the cost to the subscriber for exchange service varies from two to seven cents per connection, according to amount of use and quality of service required, and the average is not far from four cents. The price of connections from one exchange to another is from ten cents upward, according to distance, which compares most favorably with telegraph messages, since immediate response is secured and a conversation of three minutes or even more, allowing the exchange of several hundred words, instead of the ten-word message of common use in telegraphy, with considerable delay in getting replies. A telephone subscriber's wire, too, is used on an average but about five times a day, and must be maintained in idleness the rest of the time, while a telegraph company only maintains as many wires as it expects to keep busy. In Boston and its branch offices alone, for example, the Telephone Company maintains 4,565 miles of wire, which are mostly in idleness nine-tenths of the time. Different qualities of telephone service are just as necessary as different qualities of clothing, food, or railroad service, and prices of telephone exchange service must vary as surely as prices of other commodities, unless cities are willing to content themselves with the kind of equipment and service which answers in a village, which they are not. In a small town one can only reach, perhaps, one to two hundred persons; in a city, as many thousand. This is worth the difference, especially since the apparatus must be much more costly throughout. It is natural that the fact that the price of telephone service increases with the number of subscribers, instead of decreasing, should not be understood by those outside of the business; and perhaps if the practice of charging in proportion to the number of persons reached—in other words, in proportion to the facilities placed at the disposal of a subscriber—had been adopted, the reason for the increase in price would have been easier to comprehend. The calls increase very rapidly with the increase of subscribers, and this means more operators in proportion, and the operators are a large part of the expense. If those who are interested in this problem would study it out with the assistance of practical telephone men, instead of assuming that all telephone managers are trying to deceive, the matter would become much better understood. Regarding this whole attempt to restrict or harass telephone companies by attacks, such as have been common in State legislatures of late, it may be said that there is probably in the public mind a general misunderstanding of the questions involved. The facts that control telephone expense are as yet imperfectly understood by even the best telephone men, and they are constantly perverted by persons who have adverse interests, or who, for improper purposes, have instigated legislative attacks upon telephone companies.

The telephone situation is worthy of more careful attention than it has received at the hands of the public. Its features are peculiar, and the development of telephone facilities is certainly of high importance to our people. Although in the ten years that have passed since the inven-

tion became public, 156,000 miles of telephone wire have been built, over which 275,000,000 communications now pass annually, we are in reality only at the threshold of the business. It is possible already to talk with ease between Boston and Philadelphia over our experimental wire, yet the connection of our principal cities and large towns by thoroughly practicable telephone systems has, in fact, only been begun.

With the improvements which are rapidly coming into use, the aim must be nothing less than to provide a complete working system throughout the United States, which will give facilities for instant conversation between all points within many hundred miles of each other, such as is now possible within the limits of a single exchange. This cannot be accomplished by competing companies, each reaching only part of the persons wishing to become subscribers to such a system. The service is divested of half its value the moment half the people retire to a second system, and of much more should there be still further sub-division. In other words, the value of the thing consists in placing each person in the same system with each other one, and this can only be done under one general plan.

The contracts which we have made with our licensees are all shaped with this complete general telephone service in view. For purposes of intercommunication between existing smaller systems, it is arranged that all shall work together, and the fact that the telephone companies throughout the land have been held under such a general plan by the force of a government patent, has been and is of the highest importance to the public, for in no other way could even the present condition of telephone development have been reached so soon or without great confusion among competing companies and the multiplication of the wire nuisance, which would have been intolerable.

To any one who will think what it would mean, if instant verbal communication could be had by any person here with every city and town in New England, and as far as Philadelphia, perhaps even Washington and Chicago, with similar facilities in all parts of the country, it must be clear that this is something well worth the risk of money, thought, and labor by the companies; well worth encouragement from the people. The work that has been done is at least some guaranty of what will follow, if the protection promised by our patents is not interfered with. The public is ripe for the use of such a convenience, the inventive talent of the country is providing new methods for making it available; will the legislatures interprose to prevent all progress, through misconception of the problem, or because misled by interested parties?

What has already been accomplished has been under every discouragement that can be thrown upon a property resting on patent rights. But a small percentage of patented inventions prove valuable, and all such are usually compelled to run the gauntlet of lawsuits from pretenders, so long as their patents live. Capital, therefore, is timid about such investments, and nothing but the expectation of large temporary returns will bring it out for the development of a business like this.

While it is true considerable returns have been received upon our property since 1883, it is equally true that for years we were without dividends or other income from our investment; our patents have but seven years more to run, and we are still working, as always before, under a heavy fire and an expenditure for defense which nothing but a prospect of liberal returns would, for a moment, justify. To undertake such a work as has just been outlined, large sums are required for construction. It is within the power of State legislatures to so alarm capital that might be attracted to such a business, that it would be wholly useless for a time to attempt any important work of the kind suggested. The attack upon rates is one of the most direct methods of removing all inducement to extend telephone facilities; but even if the right to absolutely regulate this matter were conceded, the question whether the few thousand persons who now are connected with telephone exchanges shall have telephone service a little cheaper than at present is of trifling importance to the country, compared to the completion of a telephone system adequate to the needs of the whole people. The directors feel that the outlook ahead is promising; that there is good prospect of an early favorable termination of our most important suits, and strong reason to hope that further unjust legislation will not be seriously attempted, so that we may look forward to an opportunity to devote ourselves to the extension and completion of our telephone work.

For the Directors,
W. H. FORBES, President.

The personnel of the management remains unchanged.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, March 29, 1886.

There is now on exhibition in this city a new writing machine, having a wider scope of usefulness than the ordinary type writer. Among its superior features may be mentioned the following: The ribbon is dispensed with and printing ink is applied directly to the face of the type, thus giving a clear-cut outline to the characters. Another valuable feature is what is technically known as "variable spacing." Probably the most important feature is what the inventors term "automatic justification." As explained to me the machine will automatically make the line and carriage movements, enlarging or decreasing the width of the word-spaces as required to make the line end on an even margin as seen in a book page, instead of ending zig-zag as by the ordinary type-writer. With this method a printed page may be secured without the use of movable type, either in transfer ink on transfer paper, or in the shape of a matrix from which a cast may be taken—in either case duplicate copies may be easily secured Various styles and sizes of type may be used and a change from one size or style of type to another takes but a few sebonds.

Perhaps the feature most interesting to electricians is that a message sent from New York—say by the Associated Press—may be reproduced in any newspaper office in Philadelphia, Washington and other places in any size or style of type ready to go to press without the intervention of any other operator than the sender of the message. A company has been formed to push the inventions as rapidly as possible.

I am sorry to say that Mr. Fix, of Fulton street, this city, manufacturer of messenger call boxes, fire alarm boxes, etc., lies very sick at home. He is, I believe, the oldest manufacturer in his line, and still retains his earliest customers. I hope soon to see him out again.

Another sick man is Mr. J. W. Carter, the electrican and general manager of the United States Electrical Company. He has been detained at home for some time by pneumonia, and his company miss him the more because it is busily engaged developing several specialties. It may not be generally known that Mr. Carter was the inventor and patentee of the extension bells now in general use on magnetos, etc. The company will shortly put on the market a full line of its new motors, its sensophone, and other goods, including the new Lathrop battery and battery zinc in screw form.

The Columbia Electric Company, corner Morris and West streets, is manufacturing annunciators, etc. Mr. Hermann, of this company, was formerly of Fix & Hermann. He is a competent manufacturer of electrical supplies, and I have every reason to think he will succeed in his new departure.

Mr. Chas. H. Hinds, 418 West Twenty-seventh street, has long been interested in the manufacture of frictional machines, and was associated with Mr. Smith, the inventor of the machine for gas lighting, before that gentleman sold the patent rights to the Laflin & Rand Powder Company. Mr. Hinds is making a specialty of automatic gas lighting for churches, halls, etc., and furnishes all descriptions of burners.

The Bushwick Glass Works of William Brookfield, on Grand street, Brooklyn, have been for some little time past the scene of an experiment which promises to revolutionize the whole art of glass-blowing. The new idea which is there put into practice is so simple that the only wonder is nobody has hit upon it before. In substance it consists only in dispensing with the old-fashioned crucible in which the glass mixture was melted, and the heating and management of which made no small part of the expense and the labor of glass-producing. By the old method the first step in glass-making was crucible-making. The big crucible of molders' clay, once constructed, was wheeled upon an iron frame into a furnace, where, filled with a ton of glass mixture, it sizzled and boiled at a temperature of 3,000 degrees for twenty-four hours or more. Then the blowers stuck their long tubes into the whitehot material and blew until they used it up.

By the new process, instead of four, five or six unwieldy crucibles formerly required to keep an establishment going, all the material required for ordinary green glass is dumped into a single great tank, from which the molten glass is run off as needed through small flues into other compartments for the blowers' use. The advantages of the new method are numerous. There is no breaking of crucibles and waste of glass; the process is continuous, new mixture melting while the old is being used; the expense of fuel is considerably less; the force of men who watched and tended the crucibles, wheeling them into and out of position, is dispensed with. A German named Ferrari is the inventor of the process, and it is expected that its manifest economy will bring about a considerable reduction in the cost of articles made of the glass. It is virtually a new application of the Siemens gas furnace system, and promises to Mr. Brookfield, who is widely known as an extensive manufacturer of telegraph insulators, the rewards due to energy and enterprise.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Mass., March 29, 1886.

The Martin-Wilson Automatic Fire Alarm Company of this city has taken offices at No. 52 Broadway, New York, where a full line of its apparatus is on exhibition.

Messrs. Frenyear & Razee, of this city, and Exeter, N. H., now have a branch office, No. 67 Astor House, New York. They have just received from their printer catalogue B for 1886, containing a list of electric light supplies, with illustrations and prices. Sent free on application.

The Edison Electric Illuminating Company, of Boston, broke ground for the new central station on the 10th of February, and on the 27th of March it began public lighting at the corner of Washington and Avery streets, having placed 67 lamps in the spacious show window of Chas. Green & Company, cloth dealers and tailors. The artistic arrangement of these lamps, together with the brilliancy and the steadiness of the light, drew large crowds, notwithstanding the heavy rain. The admirers gathered around were so numerous that they blockaded the adjacent sidewalks. The company has already taken orders for 1,500 lights, which together with the lights in use at the Bijou Theatre make upward of 2,000 lamps connected with the station. Among its patrons are the Adams House, International Hotel, Young Men's Christian Union building, and the business houses of Ivers & Pond and Raymond & Fox. The station is at present equipped with the following: Three 90 h. p. Armington & Sims engines, only two of which are at present in use; six Edison dynamos, each of 400-16 c. p. capacity; three boilers supplied with Jarvis patent furnaces and the Sheffield grate bars, two being from the Whittier Co., of 125 h. p., and one from the Babcock & Wilcox Co., of 80 h. p. The entire wiring in, around, and outside the station has been done by the New England Wiring Company, and it is a very creditable piece of work. The station and superintendent's office are just back of the Adams House, corner of Head Place and Bumstead Court. Mr. A. T. Moore, Jr., is superintendent and Mr. D. K. Mullica chief engineer.

Vice-President Robert H. Wass, of the New England Insurance Exchange, has issued a circular dated March 25 to the various electric lighting companies of New England, giving advice of the appointment of a regular inspector, whose whole time shall be devoted to their interests. After the 1st prox. all inspection of electric light apparatus for the New England Insurance Exchange will be done by this inspector. This step is taken by the exchange owing to the rapid growth of the electric lighting business in the New England States.

The Fitchburg Steam Engine Company is putting in another engine at the electric light station at Middletown, Conn. The same company is fitting up a station for the Schuyler Electric Light Company at Clinton, Mass., furnishing engines, boilers and entire equipment of the plant.

The catalogue lately issued by the Page Belting Co., of Concord, comprehends all the peculiar advantages possessed by their special lines of manufacture, viz., leather and rubber belting, lace leather,—including their "Hercules" brand, also their "Dynamo" belting,—and many other features which make it of great interest to all belt users. The Roberts belt studs used by this company need to be tried but once to be adopted.

Mr. W. G. Keenan, of 73 Cornhill, reports a large number of inquiries for the new Keegan Motor, manufactured by him for supplying small power from batteries. He has on exhibition at his workshop motors running a ventilating fan, a sewing machine and a small circular saw, and they are attracting much attention.

W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, March 27, 1886.

In the report of the examiners "of educational apparatus and apparatus for high electromotive force" at the International Electrical Exhibition, in 1884, which has just been published, great praise is given to the firm of Jas. W. Queen & Co., of this city, for their fine display of goods in these lines. Among those which the examiners deemed worthy of special mention were a Gramme magneto-electric machine, a set of 20 small secondary batteries, Planté secondary battery, rheostatic machine (Breguet), Fein arc lamp, De Meritens machine, De Meritens alternating current machine, Geissler and Crookes tubes, and Diehl's electric induction incandescent lamp.

T. C. Smith, who is the agent in this city for the Westinghouse Electric Company, reports the prospects for the erection of a number of plants of this system during the summer as very good. He has just put in a plant for Jas. Doak, Jr., & Co., the large woolen mill men, which is giving complete satisfaction. He has also furnished for the same firm two steel boilers, with the Jarvis settings. Mr. Smith is an old electric light man, having been with the Thomson-Houston Company for some time.

The Schuyler Electric Light Company has fitted up handsome offices at the corner of Third and Chestnut streets in this city, and placed Stephen Holbrooke, one of the oldest men of the Thomson-Houston Company, in charge of its business. Mr. Holbrooke thoroughly understands the business in all its details, and will, no doubt, make a valuable assistant to this rapidly growing company.

Mr. James Tatham, the inventor of the lead encasing for cables, has been in Europe for some time. We understand that Mr. Tatham has been very successful in introducing his invention in Europe, and that he will probably organize a company in London for its manufacture.

George V. Cresson, the shafting and pulley manufacturer, reports trade as increasing. He is very busy filling orders taken some time since.

There is nothing that is more necessary than a good belt in the "make up" of a successful electric light plant, and Alexander Bros., of this city, are fast gaining a reputation for furnishing a belt which is specially adapted for this work.

The strikes throughout the city tend to make things very dull. In no less than a dozen mills there are strikes, and this, together with the uncertainty of trade in general, has made the business men very slow about placing any future orders. Several electric light men during the past week told me that contracts which they had taken some time since had been postponed on account of the unsettled condition.

Within the coming season it is expected that many of the places of amusement will follow in the footsteps of the Temple Theatre and introduce the incandescent light. Many of the leading hotel men have also signified their determination to fit up their whole buildings with it.

With the opening of spring the underground question is again coming to the front, though the annual report of the chief of the city's Electrical Department is not very encouraging to the advocates of a subterranean system. In that report the chief stated that the results of the visits made by himself and other members of the Electrical Committee to Washington, Brooklyn and New York to inspect the workings of the underground wires in those cities were that many different systems were found to be in use, and the progress toward the desired end was found to be very slight. He describes at length the various systems in use in these cities. He then speaks of efforts in the same direction made in this city. Out of the 342¼ miles of underground wires in Philadelphia, but 22¼ miles are in working order. There are laid in the streets 4½ miles of conduits. He takes up the various systems that have been tested by him and describes in full their workings. The results that he found were not, except in one or two cases, very satisfactory.

I cannot verify these statements, and give them only as extracts from the annual report of a municipal officer.

On the other hand, the underground people point to the forest of telegraph masts throughout the city—8,508 poles, 4,368 miles of telegraph and 157 miles of electric light wires—though they have nothing to say about the backwardness of Germany, where the government has spent already seven million dollars in experiments with the underground system.

Still, it must be clear to every one that an underground system must come in the end, and, only this week, City Councils approved an ordinance authorizing Chief Walker to lay underground conduits for electric light wires on North Broad street, from Columbia avenue north as far as an appropriation of $2,500 will extend. The chief stated that the money could be spared, and if the city operated this line the lights could be had for 40 cents per lamp per night, whereas the lowest bidder in that locality asked 75 cents. He thought it would be a good chance to experiment with underground wires.

The electric light is, in fact, growing in popular favor, and is being rapidly extended throughout the city. It may interest your readers to know the prices asked by the various companies as shown by the bids recently opened for material, work and additional arc lights for the coming year. The bids for lights were from the Northern Electric Light Company, 39 and 40 cents per lamp per night, according to location: Germantown Electric Light Company, 55 cents; Brush Company, 52½ and 62½ cents; Philadelphia Electric Lighting Company, 52½, 55, 62½, 57½ and 60 cents; United States Company, 59½, 55, 52, 75 53½, and 60 cents. The bids were ordered to be scheduled, and the chief was authorized to award contract to the best and lowest bidders, subject to the approval of the committee. It is officially proposed now to increase the appropriation for electric lighting to such an amount as will extend the service to the entire city.

At West Chester, Penn., near this city, the Edison plant has over 900 ten candle-power lamps in use, and on the streets there are 204 sixteen-candle-power lamps. They light about forty dwelling houses at present, and other houses are being rapidly wired for the light. The four No.

12 dynamos supply the town with light, but before long they will have to get a few more to meet the increasing demand.

In the rolling mills and foundries throughout the coal and iron regions gas light is being rapidly superseded by electricity.

At Lancaster, between here and Harrisburg, the United States Electric Light Company has just received the contract for lighting the city another year. The Edison Incandescent Light Company carried one branch of City Council and lost the other by one vote.

Some of your readers will be sorry to hear that many members of the Franklin Institute are in favor of retiring from the "exhibition" business. The Electrical Exhibition netted them a large sum of money, but the "Novelties" last year was, if anything, a loss. It is to be hoped, though, that the exhibitions will be continued, even if a possible deficit must be made up by private subscription.

A telephone company has just stolen a quiet march on the State. At Harrisburg, the Pennsylvania Telephone Company recently sought to file an amendment to its charter at the State Department enabling it to cover additional territory. The Attorney General decided that such action was illegal. The corporation then secured a charter for the Pennsylvania and West Jersey Telephone Company, which proposed to take in the desired territory. Since then the company sold its interest to the Pennsylvania Telephone Company, which is now in the possession of all the privileges it endeavored to obtain by the amendment of its charter.

A telephone company, in opposition to the Pennsylvania, is to be started at Easton, Pa., on or about April 1. The new company will be known as the Consolidated, and will rent telephones at half the price now charged by the Pennsylvania company.

Among the companies recently chartered at the State capital were the Edison Electric Light Company, of Erie, with a capital of $60,000, and the Electric Reporting Company of Pennsylvania, of Philadelphia, with a capital stock of $5,000. The latter company is organized for the purpose of serving financial and general news and market quotations of stocks, oil, grains, etc., by telegraph in Philadelphia, Pittsburgh, and Oil City and Bradford.

Emil Bassett, alias Edward Theodore Link, who victimized the electrical community, particularly that part of it in Australia, has been convicted here of fraud.

In the case of Daniel Coyle, an electric light lineman who was killed a week ago while monkeying with the wires, the coroner's jury, after a full investigation, has found that carelessness was the cause of his death This was a sensible finding, for there is no reason in the world why, if handled properly, the electric light should not be perfectly safe. E. F. I.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, March 27, 1886.

I have taken some pains during the last week to make inquiries among electrical manufacturers and merchants in regard to the state of trade in this industry. I have had occasion to make similar inquiries at different periods before, and am free to say that present reports are the most encouraging I ever received when commissioned on a like errand. Said the manager of the largest general electrical supply house in the West: "Business is simply booming—simply booming; we haven't enjoyed anything like such a trade in a year, and this is true of all our departments." The manager of the Western branch of one of the largest Eastern supply houses said: "Our trade is simply enormous; we have not seen anything like such a volume of business since we came West. We have secured a trade in a little over a year which we should have been well satisfied with if it represented the growth of five years." The manager of a company which has not been long in the electrical field remarked: "We actually have more business than we can attend to. We shall be obliged to extend our facilities, as our present equipment is entirely inadequate to the demands upon us." These are samples of replies received from the general supply houses. A similar satisfactory condition of affairs exists among those companies whose business includes special branches only. The electric light companies find their facilities taxed heavily, and one of our strongest concerns is building a large addition to its factory and investing several thousand dollars in new machinery. Two new electric light manufacturing companies have been lately organized—one in Chicago and one in Kansas City. The electric light business was never in better shape. From all that I can learn, I am convinced that the electrical business, as a whole and in all its branches, is better at the present time by far than it has been in eighteen months. It is not necessary to add that the manufacturers and dealers are in correspondingly good spirits. But they could get along even better with fewer strikes.

One of the handsomest places of business in Chicago is the new store of the Electrical Supply Company at 171 Randolph street. The store is 170 feet long and handsomely finished in cherry. The central portion is taken up by the desks and offices of the different department managers; the front is occupied by a fine display of electrical instruments of every description, and a portion of the rear is cut off for a shippingroom. A basement of the same proportions as the store proper is occupied by the company, and is literally packed full of electrical goods; and besides this, outside storage room is required to accommodate the large stock which is at all times carried by the company here. There is nothing in the general electrical line, from a push button to the full equipment of a telegraph system, which cannot be obtained from the company, and Mr. F. S. Terry, the manager of the Western department, aims to carry at all times just as full and complete a stock as does the establishment in the East.

Mr. J. U. Raymond, of Nos. 55 and 57 West Lake street, Chicago, is making a specialty of furnishing electric companies with the very best quality of composition and lead pipe for telegraph, telephone and electric light cables. Mr. Raymond has facilities enjoyed by few, if any, other firms in his line for furnishing on short notice lead pipe of any size or specification. In fact, he has machinery in his establishment which is not to be found in any similar establishment in the West, if, indeed, in the United States. Only the other day, it might be mentioned as an instance, he was enabled to take and execute an order for lead pipe of unusual specifications, which another manufacturer had been obliged to refuse because he did not have the machinery necessary in the case. Mr. Raymond will be glad to send circulars and particulars to those desiring same.

Mr. F. S. Terry, Manager Western Branch Electrical Supply Company, is at present in the East.

Mr. A. C. Shaw, of the Callender Cable Company, was a caller at this office the present week. Mr. Shaw reports large sales of his cable in the West.

Petoskey, Mich., is being lighted with electric light. The Grand Rapids (Thomas) system is used in conjunction with the Stanley lamps.

East Saginaw, Mich., is developing a strong local electric lighting company, which takes in Bay City and West Bay City. The plant is equipped for 550 Brush arc lights and a large number of United States incandescents.

The Jackson, Mich., Edison plant comprises 3,000 incandescent lights.

Michigan City, Ind., is to have a 40-light Indianapolis Jenney arc plant.

Colonel Geo. L Beetle, in his new relationship with the American Electrical Works, has the best wishes of a large circle of acquaintances in the West.

Mr. Charles F. Bidwell, of the Bidwell Electric Railway Company, Philadelphia, is in Chicago. He comes to see what can be done here in the way of getting capital interested in his railway system, with the idea of getting a Bidwell electric road into operation in the West.

I have received from Mr. Charles Lever, of England, a copy of his pamphlet, entitled "The Electric Light in Workshops." This little sheet is an excellent argument in favor of introducing the electrical light in manufactories.

The Crawfordsville, Ind., Electric Light Company have sold their plant to the local gas company, the consideration being $15,000.

The city of Indianapolis declares that telephone service must be offered to all alike, without discrimination, and that a contrary course on the part of the telephone company will result in an immediate repeal of the latter's franchise. This is intended to prevent the Central Union Company from removing their instruments by degrees, as proposed. W. A. K.

THE TELEGRAPH.

Memphis, Tenn.—The completion is announced of the Western Telegraph Company's line as far as Memphis, giving the city a connection with the Baltimore & Ohio Telegraph Company, and the benefits of telegraph competition.

The Oldest Operator.—Zelno P. Gordon, said to be the oldest telegraph operator in the United States, died at Castile, N. Y., last month, aged 82. For a long period he was in charge of the Erie Railroad depot at Castile, and was well-known and popular.

Sale Postponed.—Quite a large assemblage gathered at Richmond, on March 27, to attend the sale of the Southern Telegraph Company at Commissioner's sale. As the hour for the sale approached, Mr. D. H. Bates, President of the Baltimore & Ohio Telegraph Company, Mr. E. H. Stokes, President of the United Lines Telegraph Company, Mr. Robert G. Ingersoll, and representatives of the Western Union and Mutual Union telegraph companies, appeared on the scene, and there was a prospect of lively bidding for the property, which is a good one. At a little past 12 o'clock it was announced that the sale would be indefinitely postponed, an order to that effect having been entered in the United States Court at Norfolk, upon the petition of J. P. Pace, of Richmond, one of the largest bondholders of the Southern Company.

The Boston Messenger Strike.—The striking messenger boys in the service of the Boston District Telegraph Company and the Baltimore & Ohio Telegraph Company returned to work last week wholly satisfied with an agreement of their employers to pay the regular boys $4.50 and the new or special boys $3.50 weekly, with ten cents per hour for extra service. The clerks and sergeants, also, have been granted increased compensation. The boys wanted 2½ cents a message, but the substitute presented by the company was willingly accepted. Mr. W. E. Clapp, cashier of the Boston District Telegraph Company, despite the inconvenience caused by the strike, succeeded in paying the boys on the 18th of the month, as usual, which somewhat surprised the lads. The boys, however, are somewhat grieved over an order to the effect that they shall not take out more than two messages at any one time. This order was recently issued by the Baltimore & Ohio Company, and it is not improbable that they will attempt to have it rescinded, as they claim that in many cases it is not only unjust to them, but detrimental to the interests of the company.

THE TELEPHONE.

Patents in Canada.—A dispatch from Ottawa, Can., of March 24 says: The Commissioner of Patents here states that if the Bell telephone patents are declared null and void in the United States by the suit now pending, the patents held by the company in Canada would be upset. The validity of the patent, however, would not be destroyed in Canada until legal proceedings were regularly instituted.

Erie.—Erie telephone shares, it is said, have braced up this week upon the vote of the Ohio legislature deferring any regulation of telephone rates till another year. The next good news in Erie will be an increase of the quarterly dividend to ¼ per cent. This increase will occur either in April or July.

Output of Bell Instruments.—The output and return of telephones for the month ended March 20 and for the year to date is appended:

Month.	1886.	1885.	
Output	2,819	3,027	Dec. 208
Returned	1,232	2,967	Dec. 1,735
Net output	1,587	60	Inc. 1,527
Year to date.			
Output	8,822	7,171	Inc. 1,651
Returned	4,188	8,003	Dec. 3,815
Net output	4,634	*832	Inc. 5,466

* Deficiency.

The Indiana Struggle.—A dispatch of March 23 from Indianapolis says: The Supreme Court to-day decided the last of the telephone cases. The decision was given by Chief Justice Niblack. It covers the constitutionality of the two laws passed by the last Legislature for the regulation of telephone affairs, the points involved in the law reducing rentals having previously been decided in the cases of Hackett vs. the State, and in this the court reaffirmed its former opinion by simply calling attention to it. Regarding the non-discrimination act, the court holds, at length, that the telephone company is a common carrier, and as such is subject to all the regulations which the law imposes upon common carriers. It cannot, therefore, refuse service to any person who demands it and fulfills the legal requirements.

The Prosecution Fees.—The special counsel for prosecuting the Bell telephone case, Messrs. E. Hunton, C. S. Whitman and Jeff Chandler, who put in the modest charge of $1,000 each for the very little work they have thus far done, are very much annoyed because the amount of their charge has got out. They have been compelled to state that their bill was for services already rendered and that they have been employed on the case since the 1st of February, and that the fee is to cover the services to date. Solicitor General Goode has expressed himself as chagrined at the whole matter, and says that he did not see the charges when they were sent to the Controller. Every one is commenting upon the enormous charge for the small amount of work thus far done. The responsibility for employing counsel and fixing the amount to be paid rests entirely upon the Attorney General. Inquiry in regard to ex-Senator Thurman's fee elicited the fact that his charges are to be entirely contingent upon success. The bills have been sent to Mr. Goode for explanation.

THE ELECTRIC LIGHT.

Edison Machine Works.—The capital required for these new works is placed at $750,000.

Jackson, Tenn.—It is said that this city proposes to buy an electric lighting plant and to operate it.

A Preventible Accident.—At Lynchburg, Va., on March 22, an employé of the Electric Light Company, while repairing a lamp received a shock from the electric current, killing him instantly. He was on a pole and 20 feet from the ground.

The Ohmart-Homans Electric Light Company has filed articles of incorporation in the County Clerk's office, this city. The capital is $750,000, and the trustees are F. W. Homans, C. A. Homans, George B. Maynard, Elias C. Ohmart, Isadore L. Baeza, Oscar F. Gunz and Robert G. Ingersoll.

The Thomas System.—The Farmer Roller Mill Company, operating this system, have just started a plant at Petoskey, Mich., embracing one 10-light arc machine and one 400-light incandescent. Also a 75-light plant at Hillsdale, Mich., for F. W. Stock, for lighting his flour mill and residence.

Memphis, Tenn.—A company has been organized at Memphis for the purpose of putting in arc and incandescent lights, and for furnishing power. The corporation is to be called the Memphis Thomson-Houston Electric Light Company, and communications may be addressed to Mr. Matt Coen.

The Mahoning Electric Light Company, which has been organized at Youngstown with a capital of $40,000, has the following directors: C. H. Andrews, George Tod, John C. Wick, William J. Hitchcock and A. B. Cornell. The directors have elected George Tod as president and A. B. Cornell as secretary and treasurer. The new company own the franchise secured by the Thomson-Houston Electric Light Company, of Boston, to light the city, and will fulfill the contracts. The officers and directors are the same as those of the Youngstown Gas Company.

PERSONALS.

Mr. Wm. Hubbard, of "Elgin telephone" fame, is East, looking up infringers of his acoustic apparatus.

Mr. Thos. R. Taltavall, who is well known in circles telegraphic, has secured the general telegraph agency for the caligraph in this country, and for the Thomas patent feed-guide and copy-holder. Mr. Taltavall is deserving of success, and now that typewriting is a necessary accomplishment of the operator, he will probably be kept very busy.

MISCELLANEOUS NOTES.

Fire.—The building used as a factory by Messrs. Hoggson & Co., Bridgeport, Conn., the manufacturers of electrical instruments and apparatus, was visited by fire on March 23. Fortunately, the fire broke out in the day time, and it was soon checked. The total damage is between $500 and $800. Work is resumed.

SPARKS AND FLASHES.

And so Often "Charged."—Why is a bad workman like a secondary battery? Because he is so frequently discharged.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—B. & M., b 2, a 3; Western Union, b 66¼, a 66¾.

Telephone.—Am. Bell, b 156, a 158; Erie, b 27¼, a 28; New England, b 31½, a 32.

Electric Light.—No new quotations.

BUSINESS NOTICES.

Station Indicator.—J. H. Bickford & Co., Salem, Mass. have an effective railway station indicator, for which they are ready to sell territorial rights. They also sell machines complete and take equipment contracts.

Barney & Kilby, of Sandusky, O., have recently built an 80 horse-power engine for the Western Electric Company, Chicago, and one of 90 horse-power for the Sandusky Electric Light, Gas and Fuel Company.

Faraday Cable.—The American Electrical Works, Providence, R. I., call attention to the Faraday cable, of which they are the exclusive manufacturers. They claim

for it the highest insulation and the lowest inductive capacity.

Alfred F. Moore, 200-2-4 N. Third street, Philadelphia, has issued a new and neat catalogue of the more important kinds of goods made by him in insulated wires. The business has now been in existence since 1820 and enjoys a high reputation for the excellence of its productions and the readiness with which it meets new demands. The catalogue, which can be had on application, contains very full particulars, and gives gauge tables, etc.

Western Electric Company.—The improved flexible cords made by the Western Electric Company are meeting with great favor. The advantages of the new form of conductor for either telephone or switch-board cords are such as to lead to its general adoption. The Western Electric Company has been obliged to increase its facilities for the production of Disque Leclanché batteries, owing to the large demand which results from the superior materials and care employed in their manufacture.

Amperevolt.—Theo. L. C. Gerry & Co., Room 8, No. 48 Broad street, this city, offer their "Ampèrevolt" solution No. 1 for electric lighting and motors at 80 cents per gallon, and the No. 2 for small dental and surgical batteries at the same price. The inner fluid for porous cups is 25 cents. They say that a recent test of ampèrevolt solution after 65 hours' constant work on 55 ohms resistance showed the E. M. F. of the battery to be .03, the current to be .10 ampères and the internal resistance .03 ohm.

Sawyer-Man vs. Edison.—The Consolidated Electric Light Company desires to call attention to its advertisement on page iii., in regard to the patents that have been granted Sawyer & Man in incandescent lighting, covering "the incandescent conductor for an electric lamp consisting of carbon, made from a fibrous or textile material having the form of an arch or loop." The company is the owner of these patents, and promises protection to all users of the Sawyer-Man system.

Chemical Electric Light vs. Gas.—In order to reply to continual inquiry as to the number of cells of Volta Pavia batteries necessary to maintain a given number of incandescent lamps and the cost of same, the Chemical Electric Light & Power Company authorize the following table to be published:

6	Cells	will	run			2	5	candle-power	lamps.
8	"	"	"			4	5	"	"
9	"	"	"			1	8	"	"
10	"	"	"			2	8	"	"
12	"	"	"			4	8	"	"
16	"	"	"	1	16	c. p. or	5	8	c. p. lamps.
18	"	"	"	2	16	"	6	8	" "
20	"	"	"	3	16	"	8	8	" "
25	"	"	"	5	16	"	9	8	" "
30	"	"	"	8	16	"	14	8	" "

and with one charge of No. 2 B "Volta Pavia" and two renewals of the inner cup solutions at a cost, as compared with gas, as follows: 30 cells for eight 16 c. p. lamps require 1¼ gallons of No. 2 B solution and 2 gallons for two renewals of No. 5 E solution, costing the consumer 50 cents for the former and 10 cents net per gallon for the latter, viz.:

30 × 1¾ = 42 gallons @ 50c.	$21.00
1 gallon in porous cup and 1 renewal 5 E = 60 gallons @ 10c.	6.00
3 lbs. of zinc is consumed with each charge of Volta Pavia solution, which, at 6½c. per lb., 3 × 30 = 90 lbs. @ 6½c.	5.85
	$32.85
Consumption of material during 300 hours, or 11c. per hour for 8 lamps	10.95

Relative cost of gas for same illumination = 8 gas burners, each 5 ft., give 40 ft. per hour, or for 300 hours 12,000 ft. of gas; which, at $2.50 per 1,000 ft., would cost $30, or at $2.75 per 1,000 ft., would cost $33, as against $32.85 for chemical electric lights, leaving out the question of labor replenishing the cells once in 300 hours.

Volta-Pavia Solution.—It is proposed by the Chemical Electric Light and Power Company, Boston, to reduce prices on No. 2 B to 50 cents net and No. 5 E to 10 cents net, in order to meet the demand that exists for a good but low-priced article.

German Corn Remover

Kills corns and bunions, unfailing, rapid, painless; 25c.
HILL'S HAIR AND WHISKER DYE, black and brown; 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.
HALE'S HONEY, the great cough cure; 25c., 50c. and $1.
GLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED MARCH 16, 1886.

337,824. Clamp for Holding Dynamo Brushes during Filing; Mayberrie S. Eldon, Williamsport, Pa. Embraces suitably grooved bottom pieces and three upper binding screws.

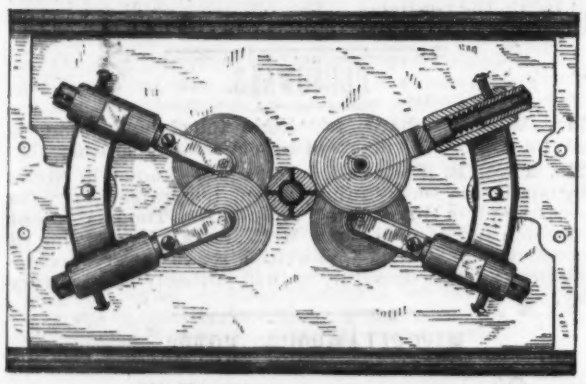
337,885. Commutator Brushes; Levi W. Stockton, Cleveland, O., assignor to the Cleveland Electric Motor Co., same place. Relates to rotary brushes, shown in the cut.

337,872, 337,873. Electric Gun; Samuel Russell, Brooklyn, N. Y., Assignor to the American Electric Arms and Ammunition Company, N. Y. They both consist of improvements upon his patent 307,070, Oct. 21, 1884.

(1) 337,896, (2) 337,897, (3) 337,899. Electric Light and Power; Charles J. Van Depoele, Chicago, Ill., Assignor of one-half of (1) to Richard H. Mather, Windsor, Conn. (1) The pole pieces of a dynamo are wound and in circuit, as shown in the cut. (2) Relates to a reciprocating motor provided with a solenoid, an iron core working therein, and a magnetic cylinder enveloping the solenoid. (3) The terminals of the filament and conducting wires are carbonized hollow natural material such as straw.

337,923. Electric Light; Harold P. Brown, Chicago, Ill. Relates to an automatic variable resistance, and consists of an improvement upon his patent of November 17, 1885.

337,931. Electro-Magnetic Motor; William H. Darling, New York, N. Y., Assignor of one-half to Gardner



337,885. COMMUTATOR BRUSH.

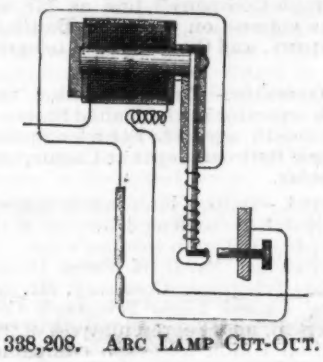
P. Harrington, same place. The engine is shown in the cut, and embraces means for controlling the current.

337,972. Telephone; James Miller, Detroit, Mich. Relates to a mouth-piece fastening and consists of a glass funnel fitting by friction into a hole.

338,009. Electrical Voting Apparatus; Charles O. Yale, Rome, N. Y.; George F. W. Holman and William J. Barnette, of the United States Navy, said Holman Assignor to said Barnette. Consists of an apparatus comprising two primary electric circuits for each voter, the opening and closing of which are effected, respectively, by means of gravity-armatures and suitable magnets, the armatures being operated by means of keys placed in suitable positions to be operated by each member, one circuit operating through suitable magnets and armatures and novel devices connected therewith to record an affirmative, and the other a negative vote opposite each member's name, and also to indicate upon suitable dials, operated by a secondary circuit, the total number of affirmative and negative votes, respectively, that are cast.

(1) 338,022. Electric Railway; (2) 338,023. Electric Motor. Edward M. Bentley, Brooklyn, N. Y. (1) Consists of branching electric conductors extending along the two branches of an electric railway, respectively, and an independent conducting-point pivoted at the termination of the two inner conductors, so as to be turned to lead the sliding contact from either main conductor onto its corresponding branch conductor. (2) Consists of an electric motor, a resistance in circuit therewith, mechanism controlling said resistance, and an automatic stop for said mechanism.

(1) 338,080, (2) 338,081, (3) 338,082, (4) 338,083, (5) 338,084, (6) 338,085, (7) 338,174, (8) 338,175. Electric Light and Power; Walter H. Knight, New York, N. Y. The first four and last two relate to electric railways, the general invention covering the combination of a branching slotted conduit having the edges of the slot fixed at the branching-point, an electric conductor in the main and in each branch conduit, a contact device extending into the conduit and adapted to move along said conductors, and a movable conductor-section in said conduit at the branching-point for guiding said contact device.

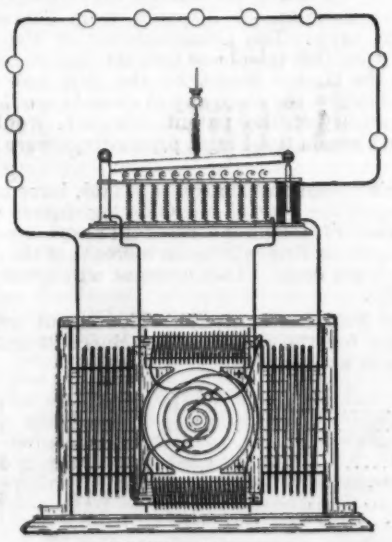


338,208. ARC LAMP CUT-OUT.

The fifth consists in a cut-out or circuit-controller placed in circuit with the translating device to be protected, and adapted to respond to abnormal increments of current, and made dependent for restoration to its

338,120. VOLT-AMPERE METER.

original condition after it has been actuated upon a second device which is operated at will, and which restores the circuit to a condition wherein the abnormal current which actuates the cut-out is impossible. The sixth



337,896. DYNAMO.

consists of two or more electric motors in multiple arc, a vehicle conveying and propelled by each, reversible commutator-brushes for each motor, and means controlled at will by the driver for actuating said brushes to change the direction of rotation of the motor, a resistance in each motor-circuit, and means for automatically controlling the same.

338,090. Electric Thermostat; Mahlon Loomis, Terra Alta, W. Va. Platinum wires are in a thermometer tube projecting therefrom, and adapted to strike against an adjustable outside electric terminal, the mercury being the opposite terminal.

338,115. Metallic Telegraph Pole; Samuel H. Terry, Brooklyn, N. Y. Embraces a hollow pole having a longitudinal groove and made up of sections, with suitable clamping devices.

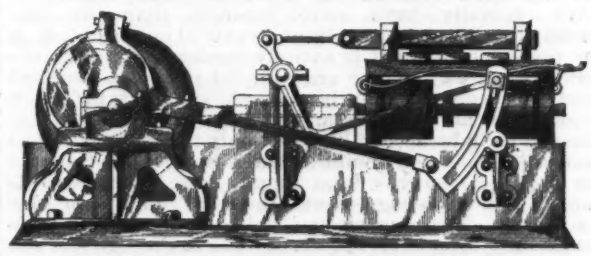
338,120. Volt-Ampere Meter; Leonard Waldo, New Haven, Conn., Assignor to L. G. Tillotson & Co., New York, N. Y. The device is clearly explained by the cut.

338,122. Electric Arc Lamp; Richard and Hugo Walther, Werdan, Saxony, Germany. Consists of magnet brake block serving as a clamp.

338,131. Spring-Jack Wedge; Homer Anderson, Peekskill, N. Y. Consists of an insulating handle, to which the conducting plates are made to adhere by means of a dovetailed joint.

338,169. Dynamo; George Forbes, London, England. Comprises a revolving mass of magnetic material constituting a naked armature, an encompassing mass of magnetic material, within which are embedded the magnetizing coils and which constitutes the field, and means for collecting the currents of electricity from the surface of the armature.

338,178. Galvanometer; O. Emil Lundstedt, Brooklyn, N. Y. Consists of an electric coil or helix, a transparent tube partly filled with a liquid and suspended in the axial line of the said helix, a rod or float free to slide within the said tube while buoyant on the said liquid and having at its lower end a substance attractable by electro-



337,931. ELECTRO-MAGNETIC MOTOR.

magnetic force, and a scale indicating the rise of the liquid displaced by the float under the influence of the electric current.

338,194. Galvanic Battery; James Serson, Boston, Mass., Assignor of one-half to William Walsh, same place. Consists of an outer jar, a porous cup resting on legs and provided with an outer and inner chamber, the said inner chamber having a perforated bottom, a carbon electrode surrounding the porous cup, a zinc electrode in the outer chamber of the porous cup, bichromate of potash crystals in the inner chamber, a solution of sulphuric acid and water in the outer chamber of the porous cup and also in the outer jar.

338,197. Oiler and Wiper for Commutator; Jacob Snowberger, Akron, O., Assignor of three-quarters to Orlando Case, U. Grant Kirn and Louis A. Smith, all of same place. Consists of a wooden block saturated with a lubricating substance and arranged to rest on the periphery of the commutator, and having the wood grain tangential to the periphery.

338,208. Cut-Out; Elihu Thomson and Edwin W. Rice, Lynn, Mass., Assignors to the Thomson-Houston Electric Company, of Connecticut. Combines a compound bar adapted to be heated by an abnormal current. The bar is shown in the cut as attached to the solenoid core.

(1) 338,150, (2) 338,224. Electric Cash and Parcel Transfer System; George F. Green, Kalamazoo, Mich., Assignor to himself, Oliver S. Kelly and Sol. J. Houck, Springfield, O. (1) Consists of an electric motor, a system of circuit wires, and a switch composed of a pivoted switch-bar and pivoted arms connected to said bar. (2) Consists of a track and a car propelled over the same by electricity, the tilting frame above the track to break the circuit between the car and track, and means for lowering the frame to establish the circuit again.